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Distribution and Abundance of Juvenile Salmonids off Oregon and Washington, 1981–1985

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Distribution and Abundance of Juvenile Salmonids off Oregon and Washington, 1981–1985

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ABSTRACT

This report is a summary of the results of 883 purse seine sets made for juvenile salmonids during 15 cruises off the coasts of Oregon and Washington during the springs and summers of 1981–1985. Juvenile coho salmon (*Oncorhynchus kisutch*) occurred most frequently, followed by chinook salmon (*O. tshawytscha*). The juveniles of these two species co-occurred more frequently than expected. Juvenile chum, pink and sockeye salmon (*O. keta*, *O. gorbuscha*, and *O. nerka*), steelhead (*O. mykiss*) and cutthroat trout (*O. clarki clarki*) were caught much less frequently and in lower numbers than coho or chinook salmon. We found no evidence of large schools of juvenile salmonids. A northerly movement of juvenile coho salmon was suggested by decreased catches off Oregon and increased catches off Washington between early and late summer. Highest catch per set of juvenile coho salmon was usually found inshore of 37.2 km. Juvenile chinook salmon were usually found within 27.9 km of the coast. Juvenile salmonids were found over a broad range of surface salinities and temperatures. High catches of juvenile coho salmon occurred in both the low salinity waters of the Columbia River plume and in adjacent higher salinity waters. Preferences for specific salinities or temperatures were not obvious for any species, although catch rates of juvenile coho salmon were highest in years when chlorophyll content was also high. Based on expansions of fish with coded wire tags, we estimated that hatchery coho salmon smolts comprised 74%, on average, of the juvenile coho salmon catches. The remaining 26% were presumably wild fish or hatchery fish released as fingerlings. Hatchery coho salmon were caught roughly in proportion to the numbers released. However, hatchery fish from the Columbia River and private coastal facilities were caught at slightly higher rates while those from coastal Washington and public coastal Oregon hatcheries were caught at slightly lower rates than expected from the numbers released. No juvenile coho salmon with coded wire tags were caught that had originated from either California or Puget Sound hatcheries.

Introduction

Our purse seining cruises in the ocean off Oregon and Washington from 1981 to 1985 represent the most extensive and intensive sampling with fine-mesh purse seines in this region. This research has provided information on the distribution, abundance, migration, and growth of juvenile salmonids (Pearcy 1984, 1988; Chung 1985; Fisher and Pearcy 1988; Pearcy and Fisher 1988), on the distribution of nonsalmonid pelagic nekton (Brodeur and Pearcy 1986), on food habits and feeding rates of juvenile salmonids (Peterson et al. 1982; Brodeur et al. 1987a; Brodeur and Pearcy 1987 and unpubl. manuscr.; Brodeur 1989, 1990; Pearcy et al., in press), on the scyphozoans caught in the purse seines (Shenker 1984), on neustonic fauna collected during these cruises (Brodeur et al. 1987b), and on the effects of the 1982–83 El Niño on the pelagic fauna (Pearcy et al. 1985; Pearcy and Schoener 1987).

In this report we summarize, for the first time, data on the distribution, abundance, and lengths of all seven species of juvenile salmonids (genus *Oncorhynchus*)—coho salmon (*O. kisutch*), chinook salmon (*O. tshawytscha*), chum salmon (*O. keta*), pink salmon (*O. gorbuscha*), sockeye salmon (*O. nerka*), steelhead (*O. mykiss*), and cutthroat trout (*O. clarki clarki*)—caught by purse seines in the ocean off Oregon and Washington 1981–1985. This report on juvenile salmonids complements the report by Brodeur and Pearcy (1986) on the nonsalmonid nekton caught in purse seines off Oregon and Washington during the same years.

Table 1

Total number (NO) and percent frequency of occurrence (FO) of juvenile salmonids in purse-seine sets in different months and years. Numbers of quantitative sets are given at the bottom for each cruise.

1981

	May		June		July		August	
	NO	FO	NO	FO	NO	FO	NO	FO
Coho	625	57%	466	45%	382	66%	371	70%
Chinook	68	40%	37	27%	73	31%	51	18%
Chum	39	10%	30	18%	33	9%	37	12%
Sockeye	1	2%	4	3%	1	1%	0	0%
Pink	1	2%	1	1%	1	1%	0	0%
Steelhead	32	22%	25	15%	5	7%	1	2%
Cutthroat	18	13%	13	9%	41	30%	14	12%
All	784	73%	576	61%	536	82%	474	73%
# Sets	63		67		67		66	

1982

	May		June		September	
	NO	FO	NO	FO	NO	FO
Coho	529	50%	825	63%	414	74%
Chinook	217	61%	228	48%	15	16%
Chum	1	2%	52	7%	151	11%
Sockeye	0	0%	20	20%	1	3%
Pink	0	0%	0	0%	47	8%
Steelhead	32	24%	2	4%	0	0%
Cutthroat	8	5%	9	14%	0	0%
All	787	76%	1136	71%	628	79%
# Sets	62		56		38	

1983

	May		June		September	
	NO	FO	NO	FO	NO	FO
Coho	196	49%	213	50%	195	35%
Chinook	128	47%	52	26%	213	27%
Chum	53	2%	3	3%	0	0%
Sockeye	54	2%	1	2%	0	0%
Pink	0	0%	0	0%	0	0%
Steelhead	4	7%	2	3%	0	0%
Cutthroat	7	9%	8	7%	0	0%
All	442	71%	279	53%	408	47%
# Sets	55		58		51	

1984

	June		July		September	
	NO	FO	NO	FO	NO	FO
Coho	222	52%	164	52%	249	44%
Chinook	104	48%	72	21%	59	19%
Chum	1	2%	132	21%	25	16%
Sockeye	3	5%	8	3%	0	0%
Pink	0	0%	256	21%	106	14%
Steelhead	8	8%	5	6%	0	0%
Cutthroat	7	6%	3	3%	0	0%
All	345	74%	642	65%	439	60%
# Sets	66		63		63	

1985

	May-June[a]		June	
	NO	FO	NO	FO
Coho	690	96%	996	63%
Chinook	533	86%	282	54%
Chum	12	21%	106	16%
Sockeye	8	21%	11	8%
Pink	0	0%	0	0%
Steelhead	8	18%	10	6%
Cutthroat	13	25%	22	19%
All	1264	100%	1427	78%
# Sets	28		80	

[a]This cruise extended from 29 May to 5 June and was restricted to a small area beyond the mouth of the Columbia River.

Methods

Salmonids were collected using 457- to 495-m herring purse seines with 32-mm mesh that fished to depths of 20 to 60 m. Although the depth that the seine fished varied among years, we have little evidence that this had a large influence on catches. Most salmon swim within the upper 20 m of the ocean, and catches of juvenile coho salmon in gill nets off Oregon were usually larger in the upper waters (0–6 m) than in deeper waters (5–12 m) (Pearcy and Fisher 1988). Chinook salmon are probably the most likely to be undersampled by surface nets because maturing fish are often caught in deep water. However the first and third highest monthly catches of juvenile chinook salmon were during 1985 when a shallow net was used which fished to a depth of 25 m. Sets were usually made along east-west transects at stations about 9.3 km apart from about the 37 m contour out to 37 or 46 km off the coasts of Oregon and

Washington (Fig. 1). Actual locations of purse seine sets are shown in Figures 4–10. Sampling methods are described in more detail in Pearcy (1984) and Pearcy and Fisher (1988).

Juvenile salmonids in their first summer in the ocean were distinguished from older immature ocean age groups or from adult salmonids on the basis of length. For all species, except chinook salmon, there was usually a large gap between the length ranges of juvenile and adult fish which facilitated separation. Pink, sockeye, and chum salmon ⩽300 mm fork length (FL) and steelhead ⩽400 mm FL were considered juveniles. Because cutthroat trout usually spend only one summer in the ocean before returning to fresh water (Giger 1972; Pearcy et al. in press) and scale data indicated that most were young fish in their initial ocean migration, they were not segregated into juvenile and adult fish. Owing to growth of juvenile coho salmon during the summer, the division between juveniles and adults for this species progressed from 300–320 mm FL in May to 420 mm FL in September. The varied life histories of different stocks of chinook salmon and year-around releases from hatcheries resulted in a broad length-range for this species caught in the ocean. For purposes of this report all chinook salmon ⩽400 mm FL were considered juveniles. This length range probably included most or all chinook salmon in their first summer in the ocean as well as many fish that entered the ocean the previous fall and winter. Generally the greatest numbers of chinook salmon were well below 400 mm FL.

Results and Discussion

Catch and Frequency of Occurrence by Species

The total numbers and frequencies of occurrence (F.O.) of all species of salmonids caught during each cruise, 1981–1985, are shown in Table 1. Coho salmon were by far the most numerous and most frequently occurring juvenile salmonid in the catches. A total of 6517 juvenile coho salmon were caught from 1981 through 1985. Juvenile coho salmon were the most numerous salmonid in 13 of 15 cruises. Chinook salmon were most abundant during September 1983 and pink salmon were most numerous in July 1984. Juvenile coho salmon were caught in over half the purse seine sets. The F.O. of coho salmon for all years and cruises averaged 58% and ranged from 35% in September 1983 to 96% in late May and early June 1985 off the Columbia River.

Numbers and F.O. of juvenile chinook salmon were usually second highest after coho salmon (Table 1). A total of 2085 juvenile chinook salmon were caught from 1981 through 1985. The F.O. of chinook salmon averaged 38% and ranged from 16% in September 1982 to 86% in May and early June 1985 off the mouth of the Columbia River. The F.O. of chinook salmon in August and September were usually less than half the F.O. in May. This was a greater decrease in F.O. than that which occurred for coho salmon.

Generally chum salmon, steelhead, and cutthroat trout were much less numerous and frequent in catches than either coho or chinook salmon. Both steelhead and cutthroat trout were absent in catches during September; the former probably because they had already migrated out of coastal waters and the latter because they had re-entered fresh water (Pearcy et al., in press). Sockeye salmon were rare, except in June 1982, when they occurred in 20% of sets and in May 1983, when a large number occurred in a single set. Pink salmon also occurred infrequently, except in September 1982 and July and September 1984, when fairly large numbers were caught. However, even when large numbers of pink salmon were caught (July 1984), F.O. were much lower than those for coho salmon (21 vs. 52%).

Juvenile salmonids occurred frequently and comprised a large proportion of the total numbers of epipelagic nekton caught in purse seines off Oregon and Washington during the summer. Juvenile coho salmon was the first to fourth most abundant species of nekton in purse seine catches in June 1979–1985 (Pearcy and Schoener 1987). Chinook salmon ranked third to eighth in abundance in June. Combined F.O. of all salmonid species in purse seine sets were high, averaging 71% and ranging from 47% in September 1983 to 100% in May and early June 1985 off the Columbia River mouth.

The relatively high average frequencies of occurrence of juvenile coho (58%) and chinook salmon (38%) and the relatively low numbers caught in individual purse seine sets (rarely more than 50 fish, and usually less than 6 fish per set [Fig. 2]) indicate that these species are fairly evenly dispersed in the shelf waters out to 37 km off Oregon and Washington and do not form large schools (*see also* Paszkowski and Olla 1985). The fairly even dispersal of coho and chinook salmon contrasts sharply with the very patchy distributions of schooling species such as Pacific herring (*Clupea harengus pallasi*), northern anchovy (*Engraulis mordax*), juvenile sablefish (*Anoplopoma fimbria*), jack mackerel (*Trachurus symmetricus*), Pacific mackerel (*Scomber japonicus*) and market squid (*Loligo opalescens*), which were all caught infrequently (average frequencies of occurrence 1979–1984 ranged from 6.9% for jack mackerel to 25.2% for market squid), but sometimes with thousands of individuals in a single set (*see* Brodeur and Pearcy 1986).

Catch per Set by Area

Average catches per set (CPUE) of each species of salmonid in three latitudinal regions (Washington, southern Washington and northern Oregon, and Oregon, [*see* Fig. 1]) for each cruise are presented in Table 2. The area off southern Washington and northern Oregon (lat. 46°45′ to 45°36′)

Table 2

Monthly mean catch/set (CPUE), numbers of juvenile salmonids and number of sets in three regions: off Washington, off southern Washington and northern Oregon, and off Oregon, 1981–1985. Blanks indicate no sampling.

Area[a]	Lat.		1981				1982			1983			1984			1985	
			May	Jun	Jul	Aug	May	Jun	Sep	May	Jun	Sep	Jun	Jul	Sep	May–Jun	Jun
Coho Salmon																	
Off Washington	48°23′–	CPUE					0.3	13.1	9.2	1.2	3.3	10.1	5.9	3.5	5.0		11.3
	46°46′	n					5	92	74	24	56	142	118	45	141		226
		Sets					19	7	8	20	17	14	20	13	23		20
Off S. Wash.	46°45′–	CPUE	6.8	12.3	5.5	9.2	1.0	14.3	13.7	5.4	6.6	1.4	3.8	3.2	5.6	24.6	24.7
and N. Oregon	45°36′	n	259	370	236	248	22	344	247	91	105	19	65	26	96	690	641
		Sets	38	30	43	27	21	24	18	17	16	14	17	8	17	28	26
Off Oregon	45°35′–	CPUE	14.6	2.6	6.1	3.2	22.8	15.6	7.8	4.5	2.1	1.5	1.3	3.2	0.7		3.8
	42°59′	n	366	96	146	123	502	389	93	81	52	34	39	60	15		129
		Sets	25	37	24	39	22	25	12	18	25	23	29	19	23		34
Chinook Salmon																	
Off Washington	48°23′–	CPUE					0.6	2.7	0.2	2.2	0.9	0.4	2.3	0.9	0.7		7.4
	46°46′	n					12	19	2	44	15	6	46	12	15		148
		Sets					19	7	8	20	17	14	20	13	23		20
Off S. Wash.	46°45′–	CPUE	1.2	0.6	1.7	1.8	6.0	8.2	0.1	4.4	1.1	2.5	2.7	0.6	0.7	19.0	4.6
and N. Oregon	45°36′	n	45	18	72	48	126	198	2	75	17	35	46	5	12	533	120
		Sets	38	30	43	27	21	24	18	17	16	14	17	8	17	28	26
Off Oregon	45°35′–	CPUE	0.9	0.5	0.04	0.1	3.6	0.4	0.9	0.5	0.8	7.5	0.4	0.4	1.4		0.4
	42°59′	n	23	19	1	3	79	11	11	9	20	172	12	8	32		14
		Sets	25	37	24	39	22	25	12	18	25	23	29	19	23		34
Chum Salmon																	
Off Washington	48°23′–	CPUE					0.0	0.0	18.9	0.0	0.2	0.0	0.1	6.4	1.0		5.0
	46°46′	n					0	0	151	0	3	0	1	83	22		99
		Sets					19	7	8	20	17	14	20	13	23		20
Off S. Wash.	46°45′–	CPUE	0.2	0.7	0.7	1.3	0.0	0.04	0.0	3.1	0.0	0.0	0.0	2.5	0.1	0.4	0.3
and N. Oregon	45°36′	n	9	21	29	35	0	1	0	53	0	0	0	20	2	12	7
		Sets	38	30	43	27	21	24	18	17	16	14	17	8	17	28	26
Off Oregon	45°35′–	CPUE	1.2	0.2	0.2	0.1	0.04	2.0	0.0	0.0	0.0	0.0	0.0	0.1	0.04		0.0
	42°59′	n	30	9	4	2	1	51	0	0	0	0	0	2	1		0
		Sets	25	37	24	39	22	25	12	18	25	23	29	19	23		34
Pink Salmon																	
Off Washington	48°23′–	CPUE					0.0	0.0	5.9	0.0	0.0	0.0	0.0	16.1	4.4		0.0
	46°46′	n					0	0	47	0	0	0	0	209	102		0
		Sets					19	7	8	20	17	14	20	13	23		20
Off S. Wash.	46°45′–	CPUE	0.03	0.03	0.02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.1	0.0	0.0
and N. Oregon	45°36′	n	1	1	1	0	0	0	0	0	0	0	0	8	1	0	0
		Sets	38	30	43	27	21	24	18	17	16	14	17	8	17	28	26
Off Oregon	45°35′–	CPUE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1		0.0
	42°59′	n	0	0	0	0	0	0	0	0	0	0	0	1	3		0
		Sets	25	37	24	39	22	25	12	18	25	23	29	19	23		34
Steelhead																	
Off Washington	48°23′–	CPUE					0.6	0.1	0.0	0.1	0.1	0.0	0.2	0.1	0.0		0.1
	46°46′	n					11	1	0	2	1	0	4	1	0		2
		Sets					19	7	8	20	17	14	20	13	23		20
Off S. Wash.	46°45′–	CPUE	0.8	0.8	0.1	0.0	0.6	0.0	0.0	0.1	0.0	0.0	0.2	0.0	0.0	0.3	0.0
and N. Oregon	45°36′	n	30	25	5	0	13	1	0	1	0	0	4	0	0	8	0
		Sets	38	30	43	27	21	24	18	17	16	14	17	8	17	28	26
Off Oregon	45°35′–	CPUE	0.1	0.0	0.0	0.03	0.4	0.0	0.0	0.1	0.04	0.0	0.0	0.0	0.0		0.2
	42°59′	n	2	0	0	1	8	0	0	1	1	0	0	0	0		8
		Sets	25	37	24	39	22	25	12	18	25	23	29	19	23		34

Table 2 (continued)

Area[a]	Lat.		1981 May	1981 Jun	1981 Jul	1981 Aug	1982 May	1982 Jun	1982 Sep	1983 May	1983 Jun	1983 Sep	1984 Jun	1984 Jul	1984 Sep	1985 May-Jun	1985 Jun
Cutthroat Trout																	
Off Washington	48°23′-	CPUE					0.0	0.1	0.0	0.1	0.1	0.0	0.0	0.0	0.0		0.0
	46°46′	n					0	1	0	1	1	0	0	0	0		0
		Sets					19	7	8	20	17	14	20	13	23		20
Off S. Wash.	46°45′-	CPUE	0.4	0.4	0.9	0.5	0.0	0.3	0.0	0.0	0.4	0.0	0.4	0.1	0.0	0.5	0.5
and N. Oregon	45°36′	n	16	11	37	13	0	7	0	0	7	0	7	1	0	13	14
		Sets	38	30	43	27	21	24	18	17	16	14	17	8	17	28	26
Off Oregon	45°35′-	CPUE	0.1	0.1	0.2	0.03	0.4	0	0	0.3	0.0	0.0	0.0	0.1	0.0		0.2
	42°59′	n	2	2	4	1	8	1	0	6	0	0	0	1	0		8
		Sets	25	37	24	39	22	25	12	18	25	23	29	19	23		34
Sockeye Salmon																	
Off Washington	48°23′-	CPUE					0.0	1.1	0.1	0.0	0.06	0.0	0.1	0.4	0.0		0.5
	46°46′	n					0	8	1	0	1	0	2	5	0		9
		Sets					19	7	8	20	17	14	20	13	23		20
Off S. Wash.	46°45′-	CPUE	0.03	0.1	0.02	0.0	0	0.5	0	3.2	0.0	0.0	0.0	0.0	0.0	0.3	0.1
and N. Oregon	45°36′	n	1	4	1	0	0	11	0	54	0	0	0	0	0	8	2
		Sets	38	30	43	27	21	24	18	17	16	14	17	8	17	28	26
Off Oregon	45°35′-	CPUE	0.0	0.0	0.0	0.0	0.0	0.04	0.0	0.0	0.0	0.0	0.03	0.0	0.0		0.0
	42°59′	n	0	0	0	0	0	1	0	0	0	0	1	0	0		0
		Sets	25	37	24	39	22	25	12	18	25	23	29	19	23		34

[a] *See* Figure 1 for delineation of the three regions.

brackets the mouth of the Columbia River (46°15′), a major source of coho and chinook salmon and steelhead. Much smaller numbers of sockeye and chum salmon and cutthroat trout also originate in the Columbia River.

The CPUE of juvenile coho salmon between early and late summer (May–June and August–September) generally increased off Washington and decreased off Oregon, suggesting a northerly movement of fish during the summer (Table 2; Pearcy and Fisher 1988). The CPUE of chinook salmon was generally higher in May and June off the Columbia River and Washington than it was off Oregon, but in late summer 1982, 1983, and 1984, CPUE was higher off Oregon than in areas to the north (Table 2). These trends are probably the result of the migration of Columbia River stocks of chinook salmon out of the sampling area by late summer and the influx of coastal Oregon stocks, many of which may enter the ocean in late summer (Nicholas and Hankin 1988; Fisher and Pearcy, unpubl. manuscr.). The CPUE of chum and the CPUE of pink salmon were generally highest off Washington and lowest off Oregon. Highest CPUE of sockeye salmon and steelhead and cutthroat trout occurred off the Columbia River although catches were generally low.

Inshore-Offshore Distributions

Average CPUE in 9.3 km (5 nautical miles [n mi]) wide intervals for all transects combined is presented in Tables 3–9 for each species. In most months peak CPUE of juvenile coho salmon occurred within 37.2 km of the coast. Exceptions occurred in September 1983, June 1984, and June 1985, when highest CPUE occurred beyond 37.1 km of the coast (Table 3). In May and June 1985, CPUE of juvenile coho salmon was exceptionally high compared with other years, especially offshore of 46.3 km of the coast in June 1985.

Highest CPUE of juvenile chinook salmon was always within 27.9 km of the coast (Table 4). However, in June 1984 the CPUE was as high offshore of 37.1 km as inshore of 27.9 km. The CPUE of juvenile chinook salmon was not exceptionally high 37.1 km offshore in June 1985 (as it was for juvenile coho salmon), but it was very high (36.6 fish/set) inshore of 9.4 km in late May and early June 1985, higher than any CPUE for coho salmon during the same period.

Highest CPUE of steelhead usually occurred offshore of 27.8 or 37.1 km of the coast (Table 5). Exceptions were June 1982, June 1983, July 1984, and June 1985, when peak CPUE was inshore of 27.9 km. Highest CPUE of cutthroat trout was offshore of 37.1 km in May 1981, May 1983, and May and June 1985. However, in other months peak CPUE was usually inshore of 27.9 km (Table 6). With few exceptions highest CPUE of juvenile sockeye, chum and pink salmon was inshore of 37.2 km (Tables 7, 8, 9).

Table 3

CPUE of coho salmon followed by number of purse seine sets in 9.3-km wide intervals (5 nmi) for all transects combined by year and month.

	Offshore Distance—Coho Salmon											
	≤9.3 km		9.4–18.5 km		18.6–27.8 km		27.9–37.1 km		37.2–46.3 km		46.4–55.6 km		55.7 km +	
1981														
May	6.2	10	13.0	21	14.9	16	1.5	6	8.5	4	1.3	6	—	—
June	5.6	21	9.9	20	2.9	9	13.2	8	2.2	8	—	—	0.0	1
July	1.0	7	5.9	31	5.9	14	14.7	7	1.2	6	0.0	2	—	—
Aug	3.2	16	4.0	20	14.8	13	3.5	13	0.3	3	1.0	1	—	—
1982														
May	16.0	5	17.7	22	2.9	16	1.2	10	0.1	8	0.0	1	—	—
June	5.6	8	25.1	15	17.9	14	11.1	13	2.0	4	0.5	2	—	—
Sept	20.6	8	17.3	11	3.8	10	4.0	5	0.2	4	—	—	—	—
1983														
May	5.3	12	6.7	11	1.2	17	2.2	13	4.5	2	—	—	—	—
June	1.5	17	5.4	17	3.1	14	7.4	7	0.3	3	—	—	—	—
Sept	3.9	20	4.3	17	4.2	6	1.5	6	9.0	1	0.0	1	—	—
1984														
June	0.3	9	3.1	21	3.1	15	3.4	14	10.2	5	4.5	2	—	—
July	2.4	10	4.3	18	2.6	14	1.9	11	0.6	10	—	—	—	—
Sept	0.5	13	6.4	19	6.1	16	1.7	13	0.0	1	0.0	1	—	—
1985														
May–June	23.1	12	33.0	7	6.5	2	33.5	4	11.7	3	—	—	—	—
June	4.0	19	7.5	11	9.4	18	20.7	20	28.0	4	27.0	3	12.4	5

Table 4

CPUE of juvenile chinook salmon followed by number of purse seine sets in 9.3-km wide intervals (5 nmi) for all transects combined by year and month.

	Offshore Distance—Chinook Salmon											
	≤9.3 km		9.4–18.5 km		18.6–27.8 km		27.9–37.1 km		37.2–46.3 km		46.4–55.6 km		55.7 km +	
1981														
May	0.8	10	2.1	21	0.8	16	0.3	6	0.3	4	0.0	6	—	—
June	1.0	21	0.7	20	0.0	9	0.2	8	0.0	8	—	—	0.0	1
July	0.3	7	2.1	31	0.2	14	0.4	7	0.0	6	0.0	2	—	—
Aug	0.1	16	1.7	20	1.0	13	0.2	13	0.0	3	0.0	1	—	—
1982														
May	5.2	5	3.3	22	5.1	16	1.6	10	2.6	8	0.0	1	—	—
June	0.6	8	4.8	15	8.4	14	2.4	13	0.5	4	0.0	2	—	—
Sept	1.4	8	0.2	11	0.2	10	0.0	5	0.0	4	—	—	—	—
1983														
May	0.8	12	4.9	11	1.8	17	2.6	13	0.0	2	—	—	—	—
June	1.8	17	0.8	17	0.3	14	0.6	7	0.0	3	—	—	—	—
Sept	10.7	20	0.0	17	0.0	6	0.0	6	0.0	1	0.0	1	—	—
1984														
June	1.4	9	2.1	21	2.0	15	0.3	14	2.0	5	2.0	2	—	—
July	3.2	10	1.7	18	0.3	14	0.5	11	0.0	10	—	—	—	—
Sept	2.5	13	1.2	19	0.2	16	0.0	13	0.0	1	0.0	1	—	—
1985														
May–June	36.6	12	3.7	7	5.0	2	12.0	4	3.3	3	—	—	—	—
June	4.3	19	3.3	11	4.7	18	3.4	20	1.2	4	1.3	3	0.6	5

Table 5

CPUE of juvenile steelhead followed by number of purse seine sets in 9.3-km wide intervals (5 nmi) for all transects combined by year and month.

	Offshore Distance—Steelhead											
	≤9.3 km		9.4–18.5 km		18.6–27.8 km		27.9–37.1 km		37.2–46.3 km		46.4–55.6 km		55.7 km +	
1981														
May	0.1	10	0.2	21	0.4	16	1.0	6	2.8	4	0.7	6	—	—
June	0.0	21	0.1	20	0.4	9	0.9	8	1.4	8	—	—	0.0	1
July	0.0	7	0.1	31	0.1	14	0.0	7	0.2	6	0.0	2	—	—
Aug	0.0	16	0.0	20	0.0	13	0.1	13	0.0	3	0.0	1	—	—
1982														
May	0.0	5	0.2	22	0.8	16	0.7	10	1.0	8	1.0	1	—	—
June	0.0	8	0.1	15	0.1	14	0.0	13	0.0	4	0.0	2	—	—
Sept	0.0	8	0.0	11	0.0	10	0.0	5	0.0	4	—	—	—	—
1983														
May	0.0	12	0.1	11	0.1	17	0.0	13	0.5	2	—	—	—	—
June	0.1	17	0.0	17	0.1	14	0.0	7	0.0	3	—	—	—	—
Sept	0.0	20	0.0	17	0.0	6	0.0	6	0.0	1	0.0	1	—	—
1984														
June	0.0	9	0.1	21	0.1	15	0.0	14	0.6	5	0.0	2	—	—
July	0.2	10	0.1	18	0.0	14	0.1	11	0.0	10	—	—	—	—
Sept	0.0	13	0.0	19	0.0	16	0.0	13	0.0	1	0.0	1	—	—
1985														
May–June	0.1	12	0.1	7	0.0	2	0.5	4	1.3	3	—	—	—	—
June	0.0	19	0.3	11	0.3	18	0.1	20	0.0	4	0.0	3	0.0	5

Table 6

CPUE of cutthroat trout followed by number of purse seine sets in 9.3-km wide intervals (5 nmi) for all transects combined by year and month.

	Offshore Distance—Cutthroat Trout											
	≤9.3 km		9.4–18.5 km		18.6–27.8 km		27.9–37.1 km		37.2–46.3 km		46.4–55.6 km		55.7 km +	
1981														
May	0.0	10	0.5	21	0.1	16	0.0	6	1.5	4	0.0	6	—	—
June	0.1	21	0.6	20	0.0	9	0.0	8	0.0	8	—	—	0.0	1
July	0.1	7	0.8	31	0.8	14	0.4	7	0.0	6	0.0	2	—	—
Aug	0.1	16	0.2	20	0.7	13	0.0	13	0.0	3	0.0	1	—	—
1982														
May	0.2	5	0.1	22	0.2	16	0.0	10	0.0	8	0.0	1	—	—
June	0.0	8	0.5	15	0.0	14	0.1	13	0.0	4	0.0	2	—	—
Sept	0.0	8	0.0	11	0.0	10	0.0	5	0.0	4	—	—	—	—
1983														
May	0.3	12	0.0	11	0.2	17	0.0	13	0.5	2	—	—	—	—
June	0.0	17	0.4	17	0.1	14	0.0	7	0.0	3	—	—	—	—
Sept	0.0	20	0.0	17	0.0	6	0.0	6	0.0	1	0.0	1	—	—
1984														
June	0.1	9	0.1	21	0.1	15	0.3	14	0.0	5	0.0	2	—	—
July	0.1	10	0.1	18	0.1	14	0.0	11	0.0	10	—	—	—	—
Sept	0.0	13	0.0	19	0.0	16	0.0	13	0.0	1	0.0	1	—	—
1985														
May–June	0.2	12	0.3	7	0.0	2	1.0	4	1.7	3	—	—	—	—
June	0.1	19	0.1	11	0.2	18	0.4	20	1.2	4	0.3	3	0.2	5

Table 7

CPUE of juvenile chum salmon followed by number of purse seine sets in 9.3-km wide intervals (5 nmi) for all transects combined by year and month.

	Offshore Distance—Chum Salmon											
	≤9.3 km		9.4–18.5 km		18.6–27.8 km		27.9–37.1 km		37.2–46.3 km		46.4–55.6 km		55.7 km +	
1981														
May	2.4	10	0.7	21	0.0	16	0.0	6	0.0	4	0.0	6	—	—
June	0.4	21	0.5	20	0.3	9	0.6	8	0.5	8	—	—	0.0	1
July	0.0	7	0.1	31	2.1	14	0.1	7	0.0	6	0.0	2	—	—
Aug	0.1	16	0.1	20	0.5	13	1.9	13	1.0	3	0.0	1	—	—
1982														
May	0.0	5	0.0	22	0.0	16	0.1	10	0.0	8	0.0	1	—	—
June	0.0	8	0.1	15	1.6	14	2.2	13	0.0	4	0.0	2	—	—
Sept	0.0	8	10.8	11	1.3	10	1.2	5	3.2	4	—	—	—	—
1983														
May	0.0	12	0.0	11	3.1	17	0.0	13	0.0	2	—	—	—	—
June	0.0	17	0.0	17	0.2	14	0.0	7	0.0	3	—	—	—	—
Sept	0.0	20	0.0	17	0.0	6	0.0	6	0.0	1	0.0	1	—	—
1984														
June	0.0	9	0.0	21	0.0	15	0.1	14	0.0	5	0.0	2	—	—
July	0.0	10	0.4	18	2.2	14	7.0	11	1.6	10	—	—	—	—
Sept	0.2	13	0.3	19	0.6	16	0.5	13	0.0	1	2.0	1	—	—
1985														
May–June	0.3	12	1.0	7	0.0	2	0.3	4	0.0	3	—	—	—	—
June	2.1	19	2.8	11	1.5	18	1.5	20	1.5	4	0.0	3	0.8	5

Table 8

CPUE of juvenile pink salmon followed by number of purse seine sets in 9.3-km wide intervals (5 nmi) for all transects combined by year and month.

	Offshore Distance—Pink Salmon											
	≤9.3 km		9.4–18.5 km		18.6–27.8 km		27.9–37.1 km		37.2–46.3 km		46.4–55.6 km		55.7 km +	
1981														
May	0.0	10	0.1	21	0.0	16	0.0	6	0.0	4	0.0	6	—	—
June	0.0	21	0.1	20	0.0	9	0.0	8	0.0	8	—	—	0.0	1
July	0.0	7	0.0	31	0.1	14	0.0	7	0.0	6	0.0	2	—	—
Aug	0.0	16	0.0	20	0.0	13	0.0	13	0.0	3	0.0	1	—	—
1982														
May	0.0	5	0.0	22	0.0	16	0.0	10	0.0	8	0.0	1	—	—
June	0.0	8	0.0	15	0.0	14	0.0	13	0.0	4	0.0	2	—	—
Sept	0.0	8	4.0	11	0.1	10	0.4	5	0.0	4	—	—	—	—
1983														
May	0.0	12	0.0	11	0.0	17	0.0	13	0.0	2	—	—	—	—
June	0.0	17	0.0	17	0.0	14	0.0	7	0.0	3	—	—	—	—
Sept	0.0	20	0.0	17	0.0	6	0.0	6	0.0	1	0.0	1	—	—
1984														
June	0.0	9	0.0	21	0.0	15	0.0	14	0.0	5	0.0	2	—	—
July	0.0	10	0.5	18	6.8	14	13.5	11	0.5	10	—	—	—	—
Sept	0.2	13	1.2	19	0.6	16	0.2	13	0.0	1	0.0	1	—	—
1985														
May–June	0.0	12	0.0	7	0.0	2	0.0	4	0.0	3	—	—	—	—
June	0.0	19	0.0	11	0.0	18	0.0	20	0.0	4	0.0	3	0.0	5

Table 9
CPUE of juvenile sockeye salmon followed by number of purse seine sets in 9.3-km wide intervals (5 nmi) for all transects combined by year and month.

	Offshore Distance—Sockeye Salmon											
	≤9.3 km		9.4–18.5 km		18.6–27.8 km		27.9–37.1 km		37.2–46.3 km		46.4–55.6 km		55.7 km +	
1981														
May	0.0	10	0.0	21	0.0	16	0.2	6	0.0	4	0.0	6	—	—
June	0.0	21	0.1	20	0.1	9	0.0	8	0.0	8	—	—	0.0	1
July	0.0	7	0.3	31	0.0	14	0.0	7	0.0	6	0.0	2	—	—
Aug	0.0	16	0.0	20	0.0	13	0.0	13	0.0	3	0.0	1	—	—
1982														
May	0.0	5	0.0	22	0.0	16	0.0	10	0.0	8	0.0	1	—	—
June	0.0	8	0.5	15	0.5	14	0.4	13	0.2	4	0.0	2	—	—
Sept	0.0	8	0.0	11	0.1	10	0.0	5	0.0	4	—	—	—	—
1983														
May	0.0	12	0.0	11	3.2	17	0.0	13	0.0	2	—	—	—	—
June	0.0	17	0.6	17	0.0	14	0.0	7	0.0	3	—	—	—	—
Sept	0.0	20	0.0	17	0.0	6	0.0	6	0.0	1	0.0	1	—	—
1984														
June	0.0	9	0.1	21	0.1	15	0.0	14	0.0	5	0.0	2	—	—
July	0.0	10	0.0	18	0.6	14	0.0	11	0.0	10	—	—	—	—
Sept	0.0	13	0.0	19	0.0	16	0.0	13	0.0	1	0.0	1	—	—
1985														
May–June	0.4	12	0.1	7	0.0	2	0.5	4	0.0	3	—	—	—	—
June	0.0	19	0.0	11	0.2	18	0.4	20	0.0	4	0.0	3	0.2	5

Catch Distributions and Oceanographic Conditions

Because of the unusually high catches of juvenile coho and chinook salmon during June 1985, we prepared maps showing contours of sea-surface temperature, salinity, and chlorophyll-*a* for this cruise (Fig. 3). These maps supplement those presented by Brodeur and Pearcy (1986) for each cruise, 1979–1984. The numbers and geographic locations of juvenile coho and chinook salmon caught in purse seines are presented by month in Figures 4 and 5, along with the 26‰ and 31‰ isohalines (when they are present). Salinity values less than 26‰ are generally indicative of low-salinity water in the plume of the Columbia River and values over 31‰ usually indicate oceanic or upwelled waters with little freshwater mixing. Cool waters during the summer (<10 °C) that denote strong coastal upwelling are shown by dark shading in the figures for coho and chinook salmon. Figures showing the catch distributions of juvenile chum, pink and sockeye salmon, steelhead and cutthroat trout do not include these salinity and temperature contours (Figs. 6–10).

Juvenile coho salmon were abundant off both Washington and Oregon (Fig. 4). In some months large catches were evident near the mouth of the Columbia River and Yaquina Bay, major points of ocean entry for hatchery coho salmon smolts. Highest catches were found at intermediate salinities of 23 to 32‰, from May to June 1981 and 1985 when large numbers of smolts were migrating from the Columbia River. Juvenile coho salmon also were caught in waters where the surface salinity varied from 12 to 34‰.

Although juvenile coho salmon were often present in the Columbia River plume (indicated by surface salinity <26‰ near latitude 46° N) and in areas of fairly low surface salinity (<31‰) adjacent to the core of the plume, they were also abundant in higher salinity (>31‰) water outside of the plume. This was particularly evident in May and June 1982, September 1983, July and September 1984, and June 1985 (Fig. 4, C and F through I) when large catches occurred where salinities exceeded 31‰. Many of the juvenile coho salmon caught in high salinity water south of the Columbia River in May 1982 (Fig. 4C) were released from Columbia River hatcheries about one month earlier. Therefore, at least some juvenile coho salmon move out of the plume within a short period after entering the ocean.

During the May–June 1985 cruise, which was confined to the region close to the mouth of the Columbia River, catches of coho salmon strongly peaked at intermediate temperatures of 13.5–14.5 °C and salinities of 23–25‰, a pattern not obvious during other cruises. During the June 1985 cruise, high catch rates (>25 fish/set) were more widely distributed between 12 °C and 17 °C and between 25 and 33‰. The highest catches of coho salmon in June 1985 occurred 46 km offshore in the fairly low salinity waters (<31‰) of the Columbia River plume (Figs. 3

Table 10

Correlation coefficients (r) for linear correlations of temperature, salinity, and chlorophyll-*a* concentration with catch of juvenile coho salmon within cruises. Probabilities that population correlation = 0: * = <0.05, ** = <0.01. (Data for 1982 and 1983 cruises from Chung 1985.)

	May	June	July	Aug	Sept
Temperature vs. catch:					
1981	−0.08	0.08	0.09	0.27*	
1982	−0.08	0.09			−0.13
1983	0.14	0.07			0.01
1984		0.30*	0.12		0.12
1985	0.17	0.18			
Salinity vs. catch:					
1981	−0.00	−0.68**	−0.01	−0.35**	
1982	0.06	−0.05			−0.27
1983	−0.10	−0.22			0.04
1984		−0.13	−0.14		−0.19
1985	0.16	−0.14			
Chlorophyll-*a* vs. catch:					
1981	0.16	0.20	−0.05	0.27*	
1982	0.26*	0.06			0.52**
1983	−0.16	0.12			−0.21
1984		0.12	0.08		0.13
1985	0.16	−0.00			

and 4I). Many coho salmon also were caught in June 1985 north of the Columbia River where salinity was 31 - 33‰. These trends suggest that large numbers of coho salmon were associated with the Columbia River plume in May and early June and subsequently dispersed in mid or late June of this year.

Large catches (>20 fish per set) of juvenile coho salmon occurred over a wide range of temperatures from 10.7 °C to 16.4 °C. Highest numbers (>100 fish per set) were caught at temperatures between 10.7 and 14.5 °C. Juvenile coho salmon sometimes were found in cold (<10 °C), newly upwelled water (e.g., in May and June 1982, July 1984, and June 1985, shaded areas in Fig. 4, C,H,I). Surface temperatures of 10 °C or less were not recorded during the other cruises, or juvenile coho salmon were not taken in these cool areas (July 1981 and June 1984, Fig. 4, B and G).

Within cruises, linear correlations between temperature, salinity or chlorophyll-*a* concentration, and the catch of juvenile coho salmon per set were generally weak and statistically insignificant ($P > 0.05$, Table 10). Quadratic equations fitted to the data to test whether catches of juvenile coho salmon peaked at intermediate temperatures were usually not significant. These data suggest that juvenile coho salmon are not concentrated in narrow ranges of salinity or temperature when they reside in coastal waters off Oregon and Washington during their first summer in the ocean. The few statistically significant linear correlations between temperature and catch and between chlorophyll *a* and catch, as well as most of the nonsignificant correlations, were positive. Conversely, the linear correlations between salinity and catch were mainly negative (Table 10). The significant negative correlations between salinity and catch of juvenile coho salmon in June and August 1981 appeared to be the result of high catches in the low salinity waters of the Columbia River plume and of low catches in higher salinity water both inshore and offshore of the plume (*See* Fig. 4, A and B). The lack of significant negative correlations between catch and salinity during May and June in most years suggests that juvenile coho salmon usually do not reside in the plume for prolonged periods of time.

Chung (1985) found that temperature was negatively correlated with salinity for all cruises in 1982 and 1983 (r ranged from −0.31 to −0.74). In May and June, the low salinity Columbia River plume water, where juvenile coho salmon were sometimes abundant, was generally warmer than the surrounding more saline water (*See also* Fig. 3 and Brodeur and Pearcy 1986). Chung also noted that the position of maximum catches relative to temperature varied with month. Peak catches were found at increasingly warmer temperatures during May, June, and September 1982, for example, and suggest that distributions are influenced by changing ocean conditions and the sea temperatures that are available rather than by a narrow, preferred, fixed temperature optimum.

In contrast to the generally weak correlations within cruises between chlorophyll-*a* concentration and catch, the correlation among years between average catch per set of juvenile coho salmon during the early summer (May and

June) and average chlorophyll-*a* concentration in early summer was strong ($r = 0.81$, Fig. 11). This strong correlation suggests that catch rates of coho salmon are higher in years when the average chlorophyll content is high. Unfortunately, only five years of data were available and the correlation was not statistically significant ($P>0.05$). Because survival of hatchery coho salmon in the Oregon area (as estimated by dividing the number of jacks returning to public hatcheries by the total number of smolts released) was positively correlated with catches of juvenile coho salmon in purse seines from June 1981 to 1985 (Fisher and Pearcy 1988), a positive relationship may exist between chlorophyll content and survival. All three of these factors (coho salmon abundance, survival, and chlorophyll content) are correlated with the intensity of coastal upwelling off Oregon (Nickelson 1986; Fisher and Pearcy 1988; Landry et al. 1989). Although these relationships suggest that high survival may be mediated through enhanced productivity of the salmon food chain, we found little evidence for increased growth or body condition of juvenile coho salmon during the relatively strong upwelling summers of 1982 and 1985, and we therefore postulated a link between upwelling and predation rates (Fisher and Pearcy 1988; Pearcy 1988).

Chinook salmon, although generally less abundant and frequently captured than coho salmon, were widely scattered in our catches off both Oregon and Washington (Fig. 5). They were also found over a broad range of salinities and temperatures. Like juvenile coho salmon, high catches were frequently made near the mouth of the Columbia River, a major source of these fish, but they were often as abundant in areas of high salinity water as they were in river plumes.

The co-occurrence of juvenile coho and chinook salmon in purse seine sets was more frequent than expected. Chi-square tests of the observed number of sets with both species were significantly greater than the expected number, if co-occurrence was random ($P<0.05$ [based on the product of frequency of occurrence of both species and the total number of sets]) for all years and for all years combined. This suggests that juvenile coho and chinook salmon are often found in or prefer similar water types.

Juvenile chum salmon (Fig. 6) were less abundant than either coho or chinook salmon off both Oregon and Washington. Most of the largest catches (July and August 1981, September 1982, May 1983, July 1984, and June 1985 [Fig. 6, B, D, E, G, and H) were north of the Columbia River where chum salmon runs are larger than in Oregon. Juvenile pink salmon were rare off Oregon. Few juvenile pink salmon were caught during the spring. Most were caught during July and September off Washington (Fig. 7, C and D), perhaps because they escaped through the mesh of the seine or were near the coast and inshore of our sampling in earlier months. The large catches of chum salmon in September 1982 and the catches of pink salmon in September 1982 and 1984 are notable, since most juvenile chum and pink salmon depart estuaries in the spring, and catches usually decline to low numbers by late summer in Georgia Strait (Healey 1980). Juvenile chum and pink salmon are known to migrate far to the north during the late summer (Hartt and Dell 1986). Apparently some juvenile chum and pink salmon reside in coastal waters off Washington for several months following ocean entry in some years.

Juvenile sockeye salmon were also very rare and usually were caught only off the Columbia River or to the north (Fig. 8). Steelhead (Fig. 9) and cutthroat trout (Fig. 10) were most often caught off both Oregon and Washington, but never in large numbers. During some cruises cutthroat trout were caught most often in the vicinity of the Columbia River.

Distribution and ocean migrations of juvenile coho salmon are discussed in more detail by Pearcy and Fisher (1988), of cutthroat trout and steelhead by Pearcy et al. (in press) and of juvenile chinook salmon by Fisher and Pearcy, unpubl. manuscr.

Length-Frequency Distributions

Length-frequency distributions for juvenile coho and chinook salmon, juvenile steelhead and cutthroat trout are discussed in Pearcy and Fisher (1988), Pearcy et al. (in press) and Fisher and Pearcy, unpubl. manuscr., respectively.

Length-frequency distributions for juvenile chum, pink, and sockeye salmon are shown in Figures 12, 13, and 14, respectively. The smallest chum salmon were caught in May when individuals less than 100–120 mm FL were most common (Fig. 12). The shift in the modal length of chum salmon from about 110–120 mm FL in May to over 200 mm FL by August and September is probably indicative of growth in the ocean. Length-frequency distributions for pink salmon are given only for periods when large catches occurred (Fig. 13). Because the catches of sockeye salmon were low, data from all years were combined for each month (Fig. 14). Sockeye salmon were most common in May and June when most were 90–150 mm FL.

Recoveries of CWT Salmonids

Release and recovery information for salmonids with coded wire tags (CWT) collected in the ocean 1981–1985 are presented in the Appendix. Out of a total of 563 CWT salmonids recovered, 307 (54%) were juvenile coho salmon (278 age 1.0 and 29 age 0.0[1]), 63 (11%) were adult coho salmon, 185 (33%) were juvenile chinook salmon (177 age

[1]Age designation follows that recommended by Koo (1962), where the numbers before and after the decimal point indicate winters spent in fresh water and in the ocean, respectively.

Table 11
Summary of recoveries of different ages of CWT juvenile salmonids by year.

	Coho			Chinook			
	Juvenile			Juvenile			Steelhead
	0.0	1.0	Adult	0.-[a]	1.0	Adult	Juvenile
1981	13	45	21	2	7	0	2
1982	8	79	8	0	34	1	1
1983	5	35	8	1	8	0	0
1984	2	22	8	5	16	2	1
1985	1	97	18	0	112	1	0
Total	29	278	63	8	177	4	4
Columbia River Origin:	0	160	22	5	167	3	2

[a]Includes both age 0.0 and 0.1 fish.

Table 12
CWT juvenile coho and chinook salmon caught in the ocean recorded by release area.

Release area	1981	1982	1983	1984	1985	Total
			Coho			
California	0	0	0	0	0	0
Oregon Coast (Pub.)	5	13	8	2	16	44
Oregon Coast (Priv.)	22	9	22	3	7	63
Columbia River	30	49	10	13	63	165
Washington Coast	1	16	0	5	12	34
Puget Sound	0	0	0	0	0	0
British Columbia	0	0	0	1	0	1
Total	58	87	40	24	98	307
			Chinook			
California	1	0	0	0	0	1
Oregon Coast (Pub.)	1	2	0	0	2	5
Oregon Coast (Priv.)	0	2	0	3	0	5
Columbia River	7	29	8	18	110	172
Washington Coast	0	1	1	0	0	2
Puget Sound	0	0	0	0	0	0
British Columbia	0	0	0	0	0	0
Total	9	34	9	21	112	185

1.0 and 8 age 0.0 and 0.1), 4 (1%) were adult chinook salmon, and 4 (1%) were juvenile steelhead (Table 11). Almost all (302 of 307) of the CWT juvenile coho salmon we caught in our purse seines were released from hatcheries as smolts (age 1. fish released from both public and private hatcheries and large, accelerated, age 0. fish released from a private hatchery).

The majority (58%) of age 1.0 juvenile coho salmon and almost all (94%) of age 1.0 juvenile chinook salmon recovered in our purse seine sets originated in the Columbia River basin. Many of the ocean-caught CWT adult coho and chinook salmon, 35% and 75%, respectively, also originated in the Columbia River basin. All but one age 0.0 juvenile coho salmon originated at the Oregon Aqua-Foods Inc. facility on the Oregon coast, while 63% of age 0.-juvenile chinook salmon originated in the Columbia River basin. The ratios of CWT to total juvenile coho and chinook salmon caught in purse seine sets 1981–1985 were 307/6517 and 185/2085, respectively.

A summary of CWT recoveries of juvenile coho and chinook salmon by release area and year appears in Table 12. The CWT juvenile coho salmon from the Columbia River were most numerous in our catches followed by, in order, those from coastal Oregon private hatcheries, other

Table 13

Estimated numbers (and percentages) in our purse seine catches of juvenile coho salmon released from hatcheries as smolts in different regions and years. These estimates were calculated by multiplying the numbers of CWT fish we caught that originated in each region by the ratios of the total number of hatchery smolts released to the total number of CWT smolts released in the same regions. The total purse-seine catch of juvenile coho salmon in each year and the estimated percentage of this total, represented by fish released from hatcheries as smolts, are also indicated.

	Estimated number of hatchery smolts (% of total)				
Release area	1981	1982	1983	1984	1985
California	0	0	0	0	0
Oregon Coast (Public)	32(2.6)	87(6.4)	27(5.2)	10(2.8)	81(5.6)
Oregon Coast (Private)	389(32.1)	207(15.2)	362(69.6)	66(18.4)	57(3.9)
Columbia River	698(57.7)	815(59.8)	131(25.2)	215(60.2)	1198(82.4)
Washington Coast	91(7.5)	254(18.6)	0(0.0)	66(18.5)	118(8.1)
Expanded Total	1210	1363	520	357	1454
Total Catch	1844	1768	604	635	1686
% of Total Catch	66%	77%	86%	56%	86%

coastal Oregon locations and coastal Washington locations. No CWT juvenile coho salmon released in California or Puget Sound and only one fish released in British Columbia were caught in our purse seines; perhaps few juveniles from these areas enter the coastal Oregon and Washington waters during their first summer in the ocean.

We estimated the contributions of hatchery coho salmon smolts originating from five sources (California, coastal Oregon public, coastal Oregon private, Columbia River, and coastal Washington hatcheries) to our ocean catch in each year by multiplying the numbers of CWT fish we caught from each source by an expansion factor. This expansion factor was used for each source in each year:

$$\frac{\text{total no. hatchery.smolts released}^{2}}{\text{total no. CWT smolts released}}$$

Based on these expansions, hatchery coho salmon smolts accounted for between 56% and 86% (five year average = 74%) of our total catch of juvenile coho salmon in the ocean (Table 13). The remaining 14–44% (average 26%) were presumably wild fish or hatchery-reared fish released as fingerlings. The high percentage of hatchery coho salmon in our catches is consistent with data presented by Bottom et al. (1986) showing that in recent years wild smolts have decreased to only 8% or less of total coho salmon smolt production from California through the southern Washington coast. Of the hatchery fish, those from the Columbia River were most numerous, followed by, in order, fish from Oregon private hatcheries, coastal Washington hatcheries, and coastal Oregon public hatcheries (5-yr means = 57%, 28%, 11%, and 5% of hatchery fish, respectively).

In most years Columbia River fish were caught at a higher rate than that region's smolt contribution, probably because the mouth of the Columbia River was in the middle of the latitudinal range of our sampling, and fish migrating both to the north and south of the Columbia River were equally susceptible to capture (Table 14). Conversely, coastal Washington fish were always caught at a proportionally lower rate than that region's smolt contribution, perhaps because much of our sampling was to the south of where these fish were released and migration is known to be primarily to the north, out of our sampling area. Surprisingly, no CWT juvenile coho salmon released as smolts from California were captured. Likewise, no Puget Sound smolts were caught during our sampling off Oregon and Washington, although one juvenile coho salmon released as a fingerling from a British Columbia river was captured off northern Washington and 24 adult coho salmon originating in Puget Sound (38% of our total catch of CWT adult coho salmon) were also caught, mostly off Washington. These data suggest that few juvenile coho salmon from California, Puget Sound, or British Columbia migrate into the coastal waters off Oregon and Washington during their first summer in the ocean.

In early summer, many CWT juvenile coho salmon were caught to the south of where they entered the ocean. By late summer, however, most large CWT juvenile coho salmon (>300mm FL) that originated in Oregon or in the Columbia River and that grew in the ocean for a period of several months following release, were caught off northern Oregon and Washington. This suggests that although

[2]Data on total smolts released in each region were obtained from Tom Lichatowich, Oregon Department of Fish and Wildlife, Portland, OR and D. O'Conner, Washington Department of Fisheries, Olympia, WA; data on total releases of CWT smolts were obtained from J.K: Johnson, Pacific States Marine Fisheries Commission, Portland, OR.

Table 14

Estimated percentage contribution to our purse-seine catches of juvenile coho salmon that originated from hatcheries in each of five areas, and (in parentheses) the percentage contribution of each area to the total release of smolts from California through the Washington coast in different years.

	California	Coastal Oregon (Private)	Coastal Oregon (Public)	Columbia River	Coastal Washington
1981	0(1.3)	32.1(31.8)	2.6(5.2)	57.7(43.8)	7.5(18.0)
1982	0(0.7)	15.2(33.1)	6.4(6.2)	59.8(39.7)	18.6(20.3)
1983[a]	0(1.2)	69.6(28.3)[a]	5.2(5.3)	25.2(47.9)	0(17.3)
1984	0(0.5)	18.4(18.4)	2.8(7.6)	60.4(51.4)	18.5(22.1)
1985[b]	0(0.2)	0(16.2)	5.7(7.3)	92.9(53.6)	1.4(22.7)
1985[c]	0(0.2)	7.9(16.2)	5.7(7.3)	71.3(53.6)	15.0(22.7)
1981–1984 (mean)	0(0.9)	33.8(27.9)	4.3(6.1)	50.8(45.7)	11.2(19.4)

[a] We probably overestimated the proportion of coastal Oregon private hatchery fish in our catches in 1983. In this year many of the CWT private hatchery fish were caught in three sets close to where the fish were released, and were from a single release group that included a very high percentage of tagged fish. Therefore the expansion factor we used to estimate total numbers of private hatchery fish in our sets, which was based on the average marked to unmarked ratio for all private hatchery groups released during the year, was probably too high.

[b] Sampling near the mouth of the Columbia River from late May to early June 1985.

[c] Coastwide sampling, but in June only.

there is slow movement to the north during the summer, many coho salmon do not rapidly migrate far away from where they entered the ocean but linger in the local area. (*See* Pearcy and Fisher 1988 for more details.) Most CWT chinook salmon were caught to the north of where they entered the ocean, especially during the warm water years of 1983 and 1984 (Fisher and Pearcy, unpubl. manuscr.). During other years some fish from the Columbia River were captured south of where they entered the ocean, and in May 1982 most Columbia River chinook salmon smolts were captured south of the Columbia River, similar to the pattern found for juvenile coho salmon.

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Citations

Bottom, D.L., T.E. Nickelson, and S.L. Johnson.
1986. Research and development of Oregon's coastal salmon stocks. Coho salmon model. Oregon Dep. Fish. Wildl. Ann. Prog. Rep., 29 p.

Brodeur, R.D.
1989. Neustonic feeding by juvenile-salmonids in coastals waters of the Northeast Pacific. Can. J. Zool. 67:1995–2007.
1990. Ontogenetic variations in the type and size of prey consumed by juvenile coho, *Oncorhynchus kisutch*, and chinook, *O. tschwytscha* salmon. Env. Biol. Fishes (in press).

Brodeur, R.D., and W.G. Pearcy.
1986. Distribution and relative abundance of pelagic nonsalmonid nekton off Oregon and Washington, 1979–84. NOAA Tech. Rep. NMFS 46, 85 p.
1987. Diel feeding chronology, gastric evacuation and estimated daily ration of juvenile coho salmon, *Oncorhynchus kisutch* (Walbaum), in the coastal marine environment. J. Fish. Biol. 31: 465–477.

Brodeur, R.D., W.G. Pearcy, and H.V. Lorz.
1987a. Food habits and dietary variabilities of pelagic nekton off Oregon and Washington, 1979–1984. NOAA Tech. Rep. NMFS 57, 32 p.

Brodeur, R.D., B.C. Mundy, W.G. Pearcy, and R.W. Wissmar.
1987b. The neustonic fauna in coastal waters of the Northeast Pacific: abundance, distribution, and utilization by juvenile salmonids. Oregon State Univ., Sea Grant Publ. ORESU-T-87-001, 61 p.

Chung, A.W.
1985. Relationships between oceanographic factors and the distribution of juvenile coho salmon (*Oncorhynchus kisutch*) off Oregon and Washington. M.S. Thesis, Oregon State Univ., 116 p.

Fisher, J.P., and W.G. Pearcy.
1988. Growth of juvenile coho salmon (*Oncorhynchus kisutch*) in the ocean off Oregon and Washington, USA, in years of differing coastal upwelling. Can. J. Fish. Aquat. Sci. 45:1036–1044.

Giger, R.D.
1972. Ecology and management of coastal cutthroat trout in Oregon. Oregon State Game Comm., Fish. Res. Rep. No. 6, 61 p.

Hartt, A.C., and M.B. Dell.
1986. Early oceanic migrations and growth of juvenile Pacific salmon and steelhead trout. Int. Pac. Fish. Comm. Bull. 46, 105 p.

Healey, M.C.
1980. The ecology of juvenile salmon in Georgia Strait, British Columbia. *In* Salmonid ecosystems of the North Pacific (W.J. McNeil and D.C. Himsworth, eds.), p. 203–229. Oregon State Univ. Press, Corvallis.

Koo, T.S.Y.
1962. Age designation in salmon. *In* Studies of red salmon (T.S.Y. Koo, ed.), p. 41–48. Univ. Washington Press, Seattle.

Landry, M.R., J.R. Postel, W.K. Peterson, and J. Newman.
1989. Broad-scale distributional patterns of hydrographic variables on the Washington/Oregon shelf. *In* Coastal oceanography of Washington and Oregon (M.R. Landry and B.M. Hickey, eds.), p. 1–40. Elsevier Oceanography Series 47, Amsterdam.

Nicholas, J.W., and D.G. Hankin.
1988. Chinook salmon populations in Oregon coastal river basins: Description of life histories and assessment of recent trends in run strengths. Oregon Dep. Fish Wildl. Res. Develop. Sect., Info. Rep. 88-1, 359 p.

Nickelson, T.
1986. The influence of ocean conditions on abundances of coho salmon (*Oncorhynchus kisutch*) in the Oregon Production Area. Oregon Dep. Fish Wildl. Info. Rep. 83-6, 23 p.

Paszkowski, C.A., and B.L. Olla.
1985. Social interactions of coho salmon (*Oncorhynchus kisutch*) smolts in seawater. Can. J. Zool. 63:2401–2407.

Pearcy, W.G.
1984. Where do all the coho go? The biology of juvenile coho salmon off the coasts of Oregon and Washington. *In* Influence of ocean conditions on the production of salmonids in the North Pacific (W.G. Pearcy, ed.), p. 50–60. Oreg. State Univ. Sea Grant Coll. Prog. (ORESU-W-83-001), Corvallis.
1988. Factors affecting survival of coho salmon off Oregon and Washington. *In* Salmon production, management, and allocation (M.J. McNeil, ed.), p. 67–73. Oregon State Univ. Press, Corvallis.

Pearcy, W.G., and J.P. Fisher.
1988. Migrations of coho salmon, *Oncorhynchus kisutch* during their first summer in the ocean. Fish. Bull., U.S. 86:173–195.

Pearcy, W.G., and A. Schoener.
1987. Changes in the marine biota coincident with the 1982–1983 El Niño in the northeastern subarctic Pacific Ocean. J. Geophys. Res. 92, No. C13:14,417-14,428.

Pearcy, W., J. Fisher, R. Brodeur, and S. Johnson.
1985. Effects of the 1983 El Niño on coastal nekton off Oregon and Washington. *In* El Niño North (W.S. Wooster and D.L. Fluharty, eds.), p. 188–204. Univ. Washington Sea Grant Prog., Seattle.

Pearcy, W.G., R.D. Brodeur, and J.P. Fisher.
In press. Distribution and ecology of juvenile cutthroat trout (*Oncorhynchus clarki clarki*) and steelhead (*O. mykiss*) in the ocean off Oregon and Washington. Fish. Bull., U.S.

Peterson, W.T., R.D. Brodeur, and W.G. Pearcy.
1982. Food habits of juvenile salmon in the Oregon coastal zone, June 1979. Fish. Bull., U.S. 80:841–851.

Shenker, J.M.
1984. Scyphomedusae in surface waters near the Oregon coast, May–August, 1981. Est. Coast Shelf Sci. 19:619–632.

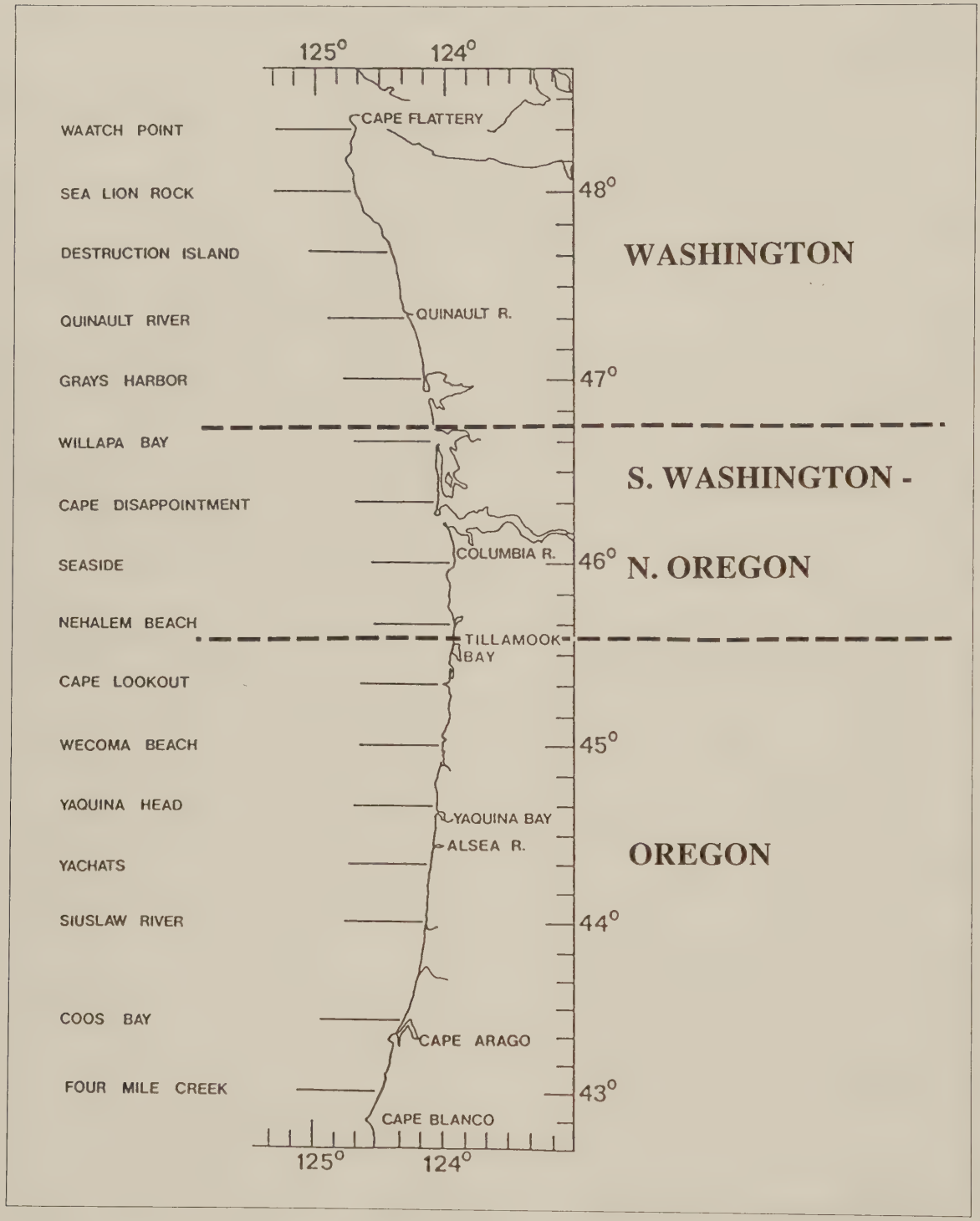

Figure 1

Transects frequently sampled during purse-seine cruises, 1981–1985, and the three regions used for grouping of data in Table 2.

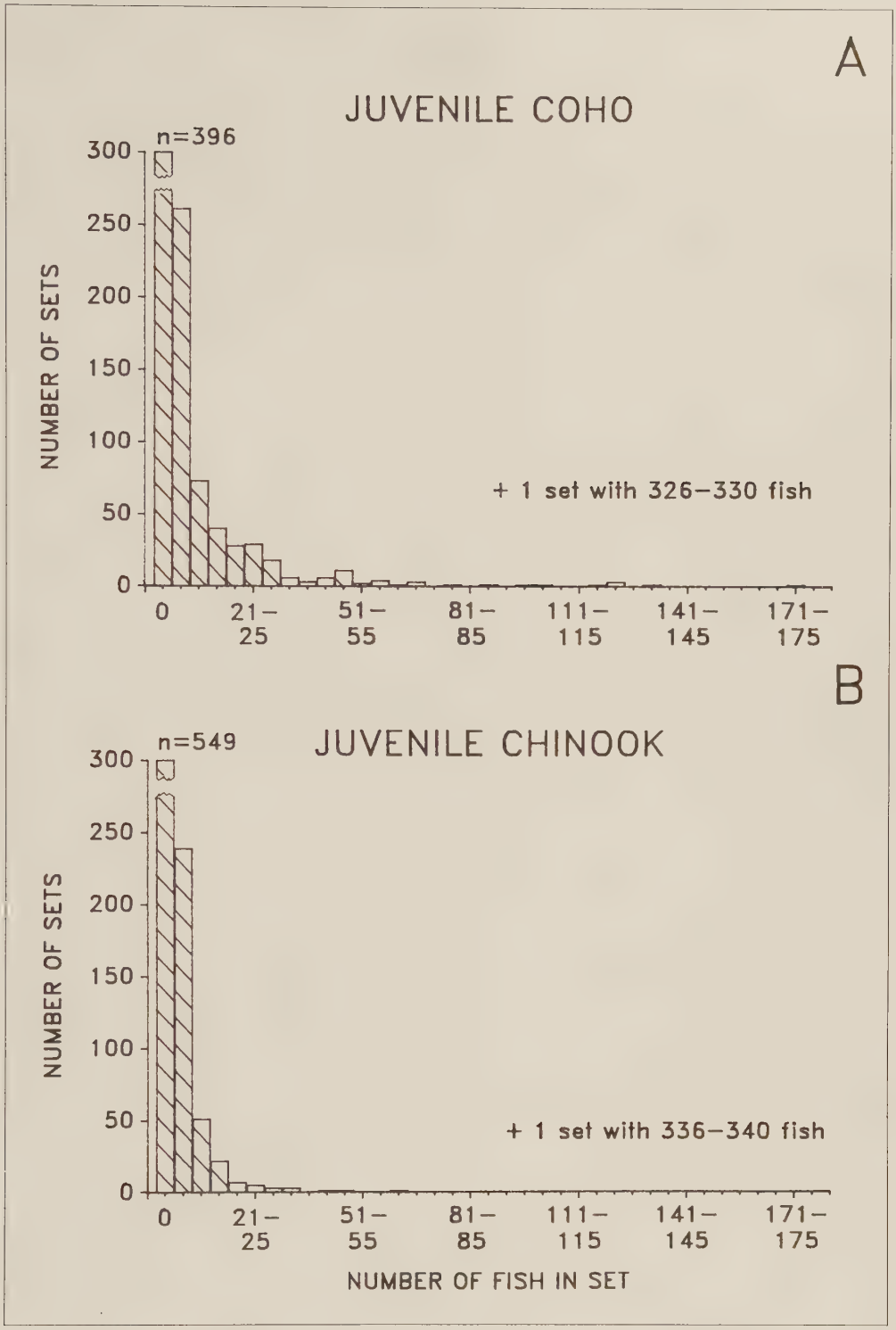

Figure 2
Frequency distributions of the number of juvenile coho (**A**) and chinook salmon (**B**) caught in purse-seine sets, 1981–1985.

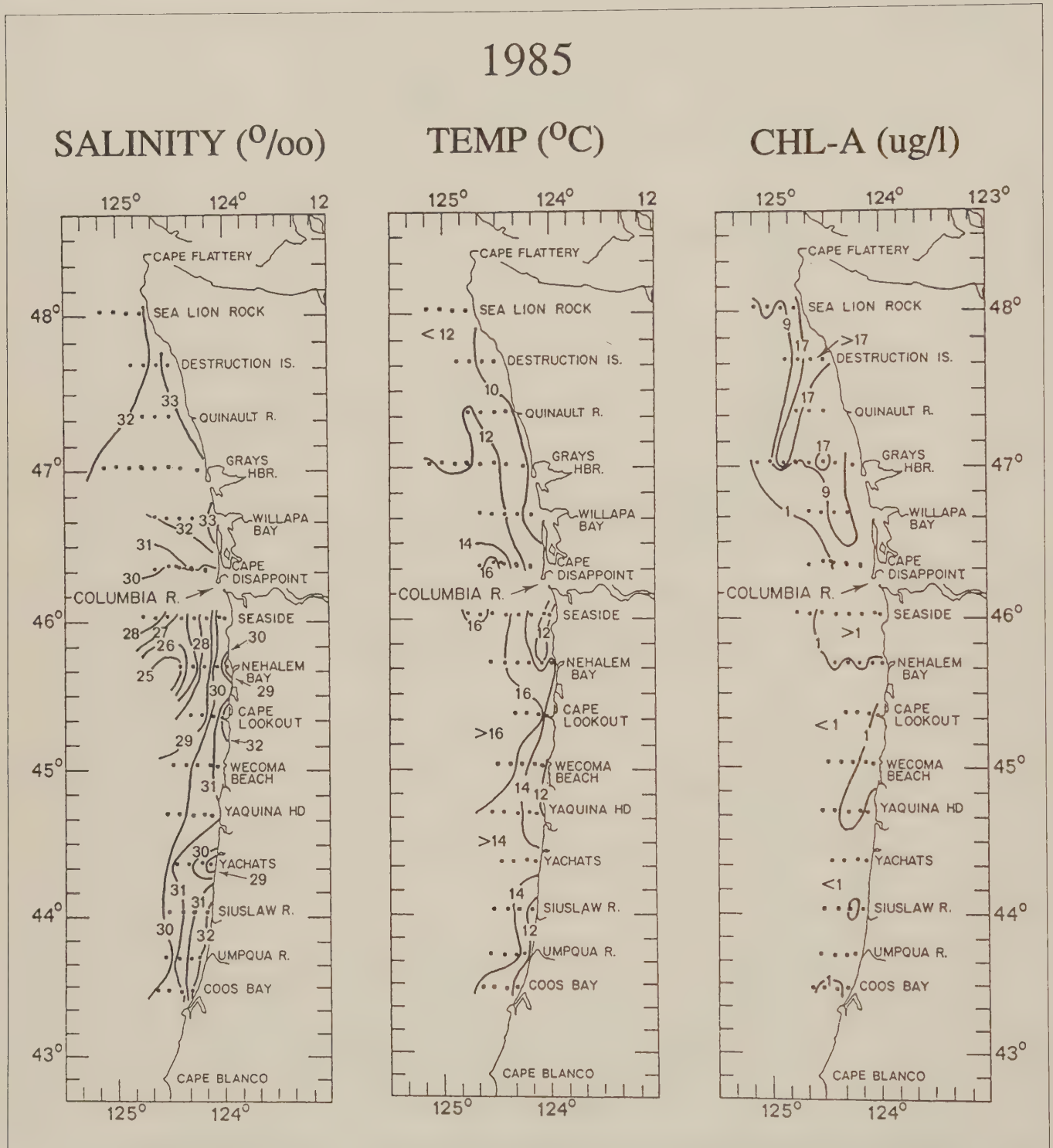

Figure 3

Near-surface (0–1 m) salinity, temperature, and chlorophyll-*a* distributions off Oregon and Washington, 10–25 June 1985. Dots indicate locations of purse-seine sets.

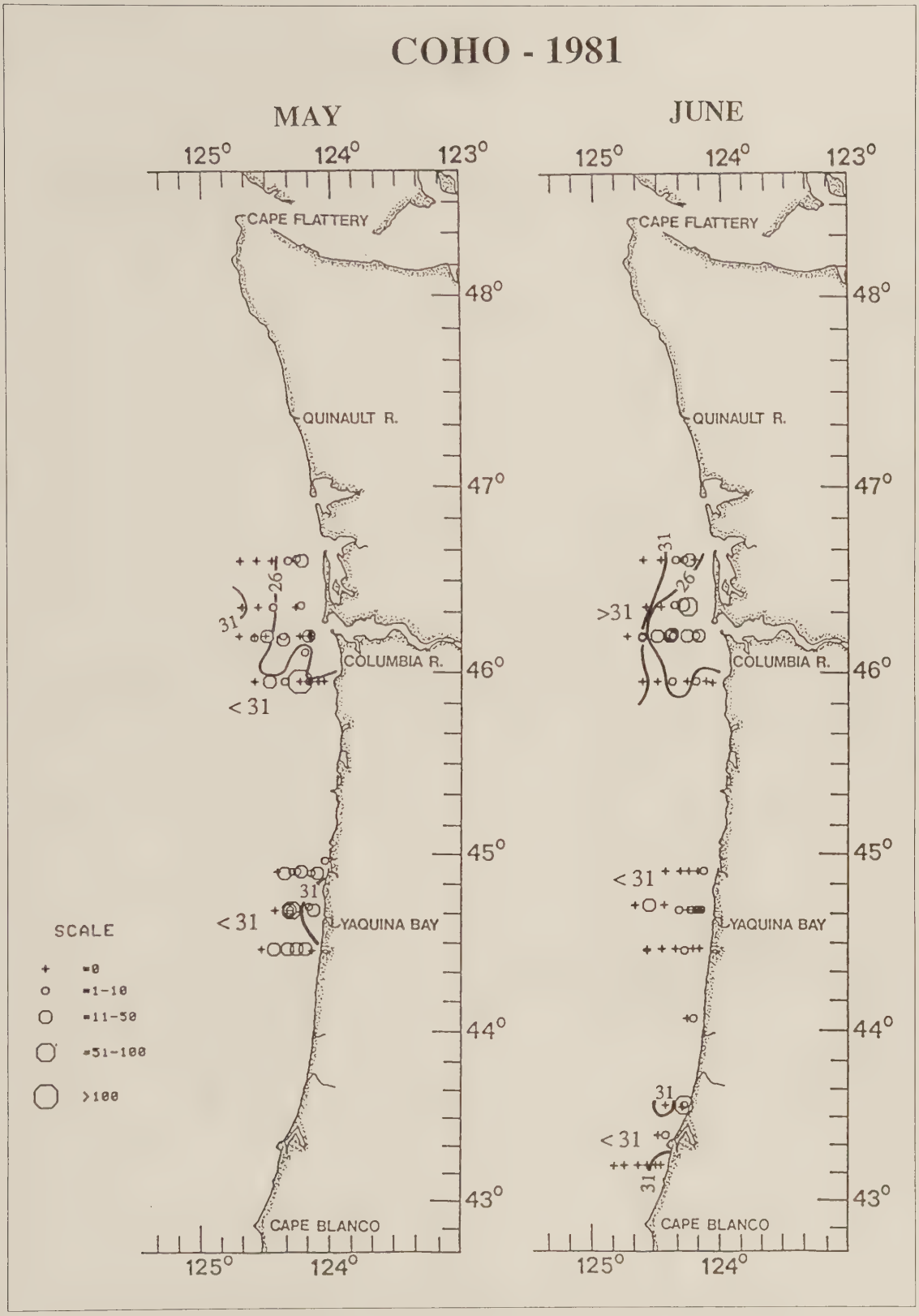

Figure 4A

Catch distribution (number/set) of juvenile coho salmon off Oregon and Washington for each cruise. Sampling was extended to British Columbia and California in 1984. The 26 and 32‰ surface isohaline lines are also indicated as well as areas where the surface temperature was ≤10.0 °C (shaded).

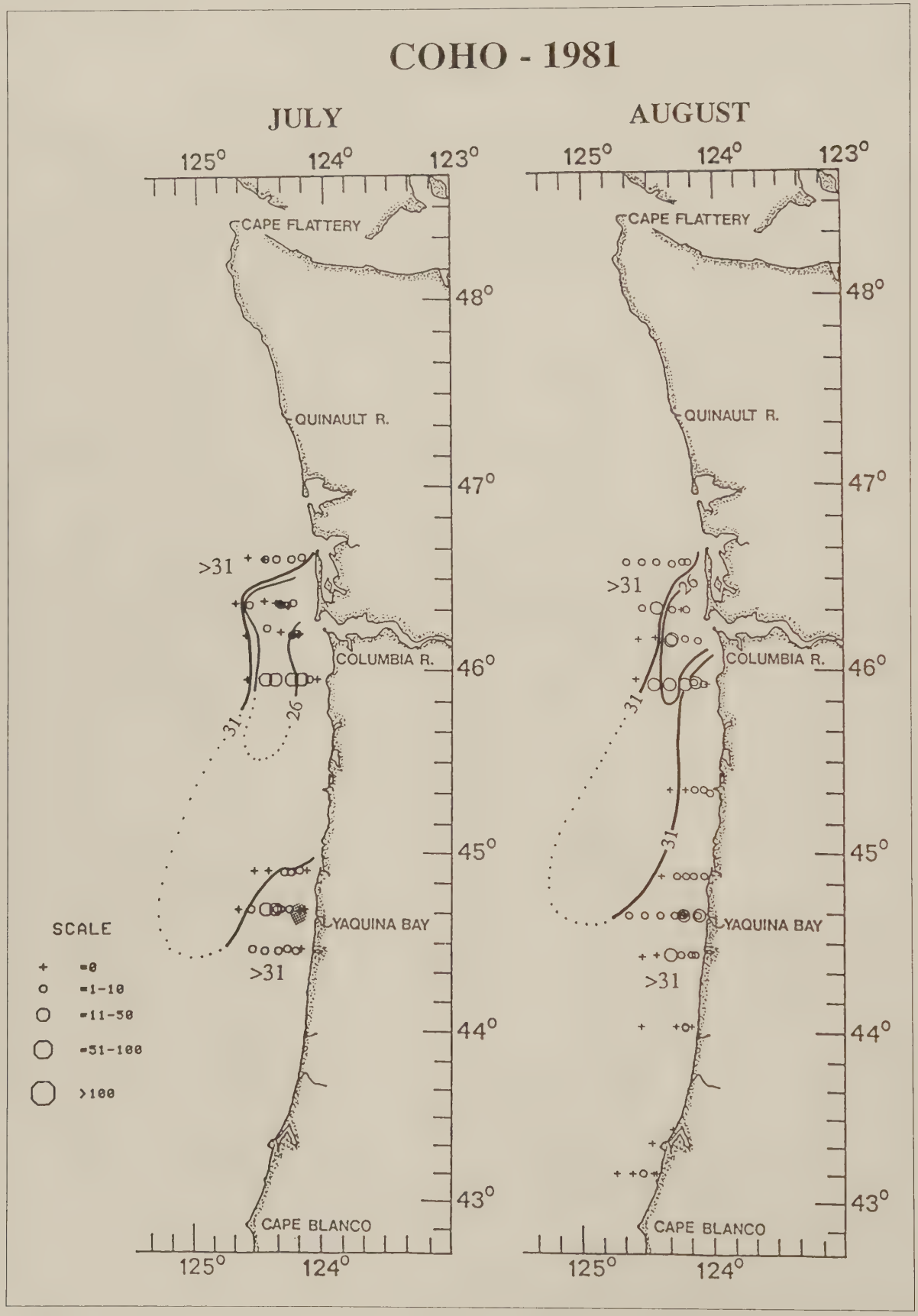
COHO - 1981
JULY
AUGUST
125°
124°
123°
CAPE FLATTERY
QUINAULT R.
COLUMBIA R.
YAQUINA BAY
CAPE BLANCO
48°
47°
46°
45°
44°
43°
>31
31
26
SCALE
+ =0
o =1-10
o =11-50
o =51-100
o >100

Figure 4B

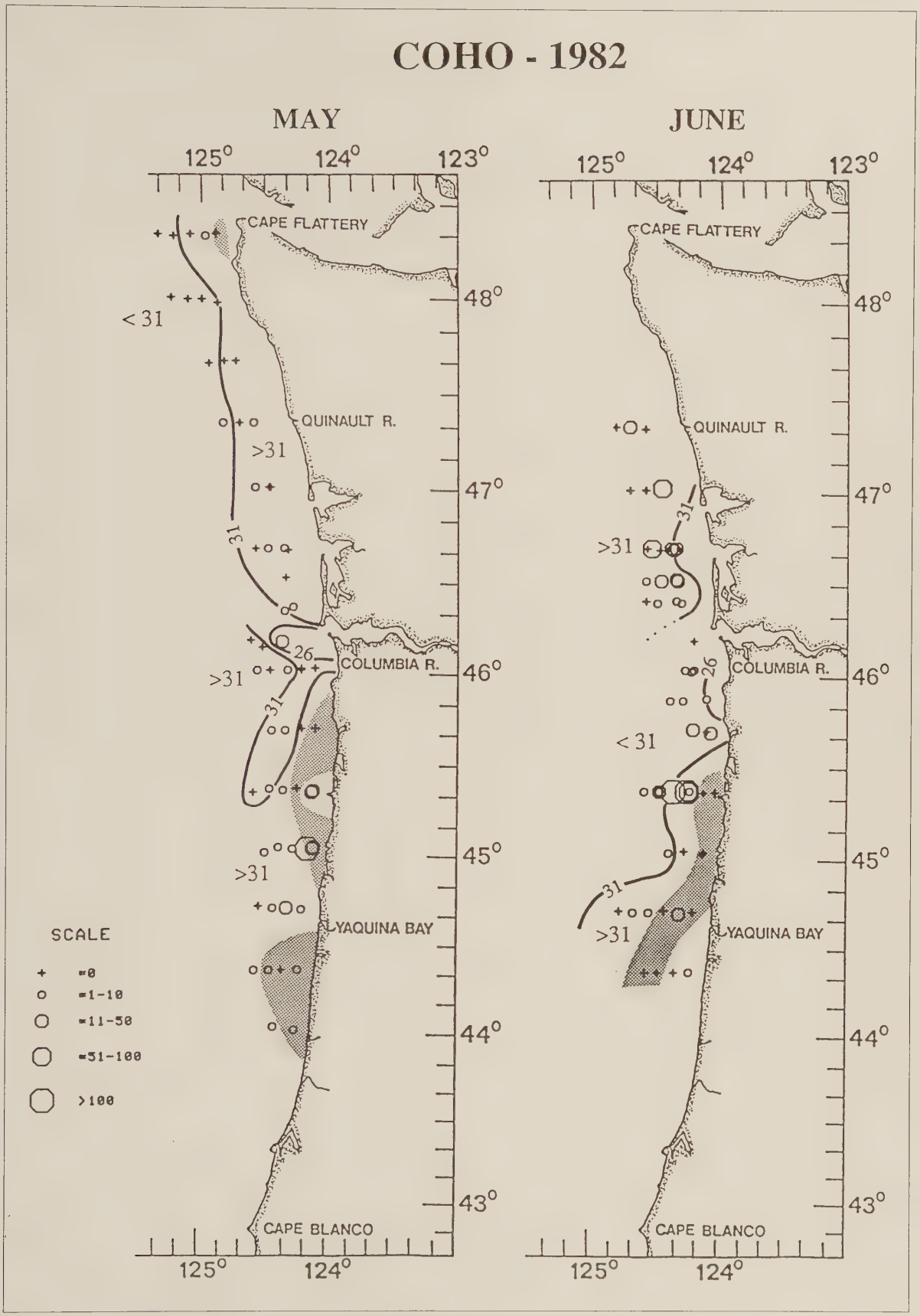
COHO - 1982
MAY
JUNE
125°
124°
123°
48°
47°
46°
45°
44°
43°
CAPE FLATTERY
QUINAULT R.
COLUMBIA R.
YAQUINA BAY
CAPE BLANCO
<31
>31
31
26
SCALE
+ =0
o =1-10
O =11-50
=51-100
>100

Figure 4C

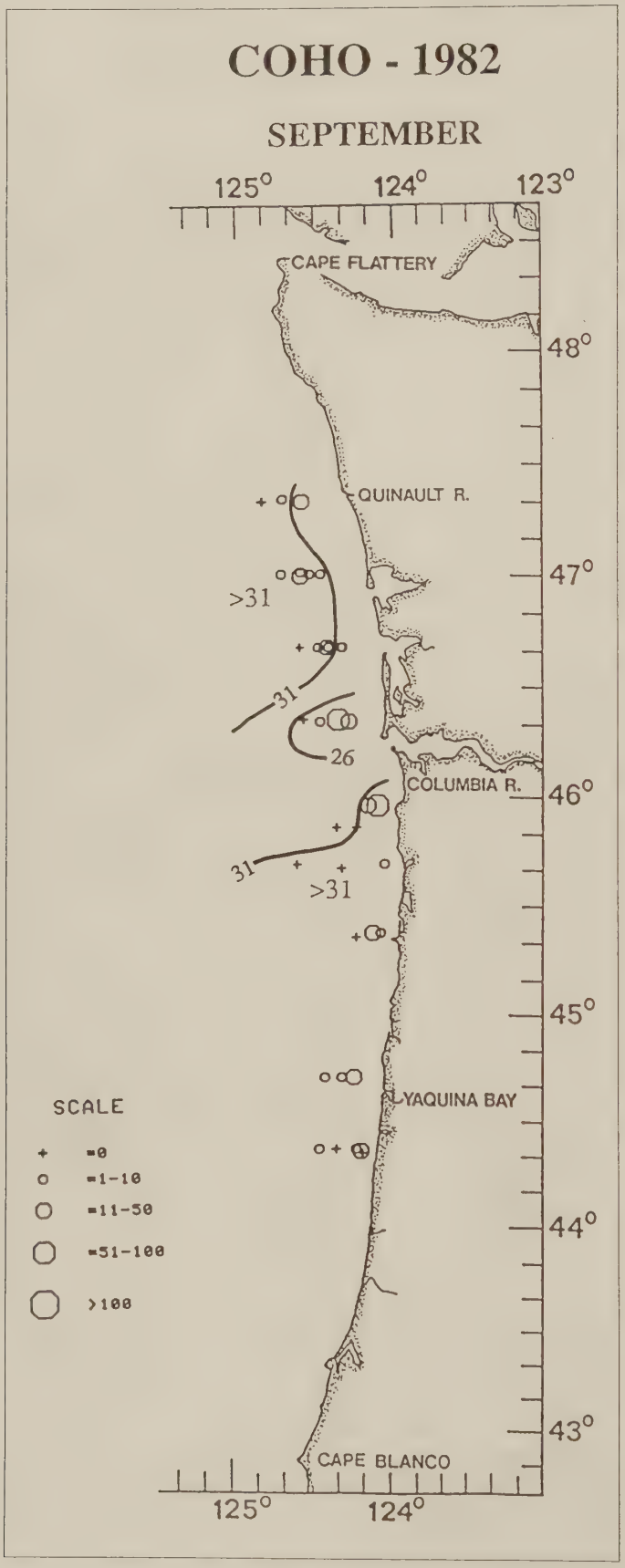
COHO - 1982
SEPTEMBER
125°
124°
123°
CAPE FLATTERY
48°
QUINAULT R.
47°
>31
31
26
COLUMBIA R.
46°
31
>31
45°
YAQUINA BAY
SCALE
+ =0
o =1-10
=11-50
=51-100
>100
44°
43°
CAPE BLANCO
125°
124°

Figure 4D

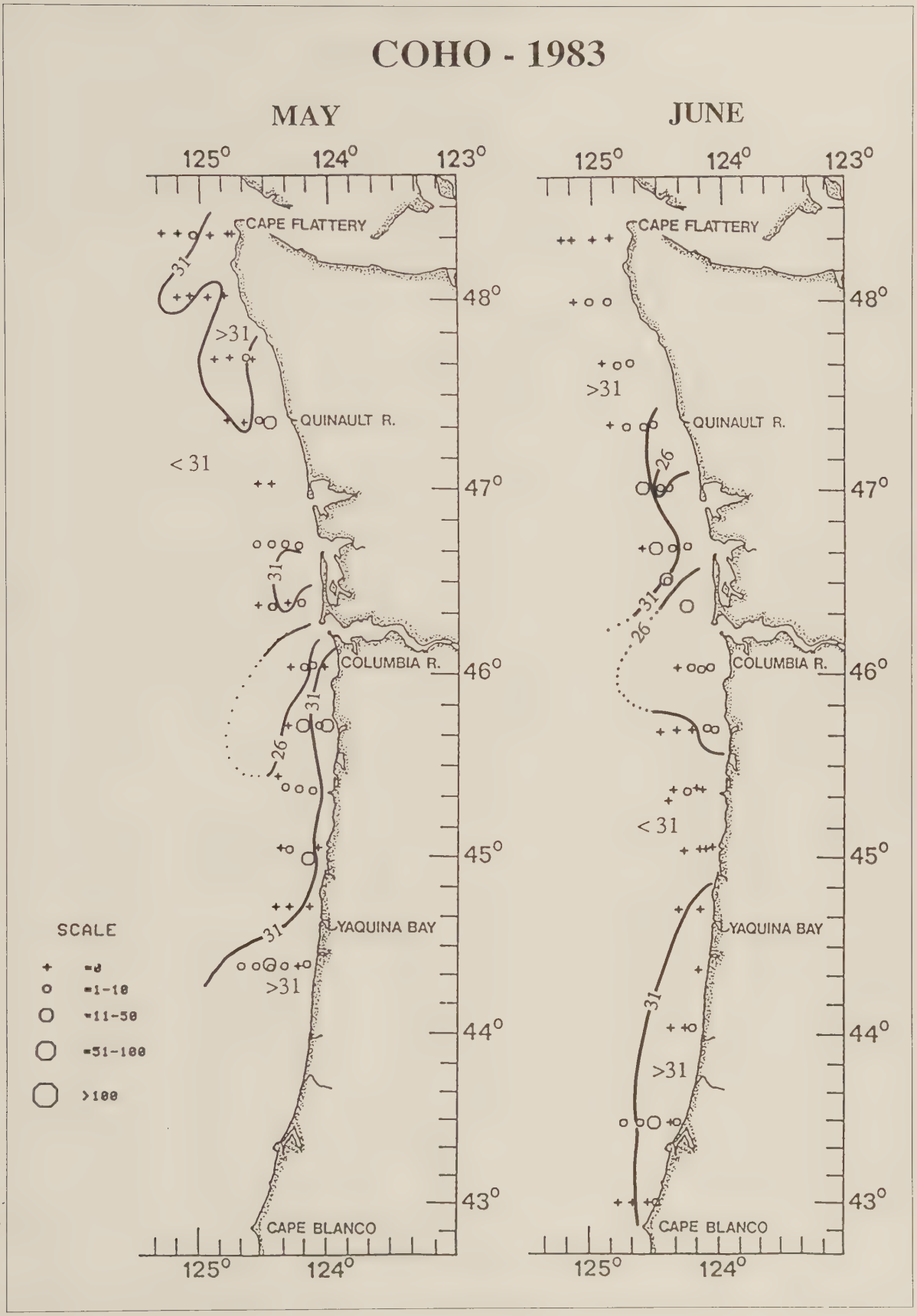
COHO - 1983
MAY
JUNE
125°
124°
123°
48°
47°
46°
45°
44°
43°
CAPE FLATTERY
QUINAULT R.
COLUMBIA R.
YAQUINA BAY
CAPE BLANCO
< 31
>31
31
26
SCALE
=0
=1-10
=11-50
=51-100
>100

Figure 4E

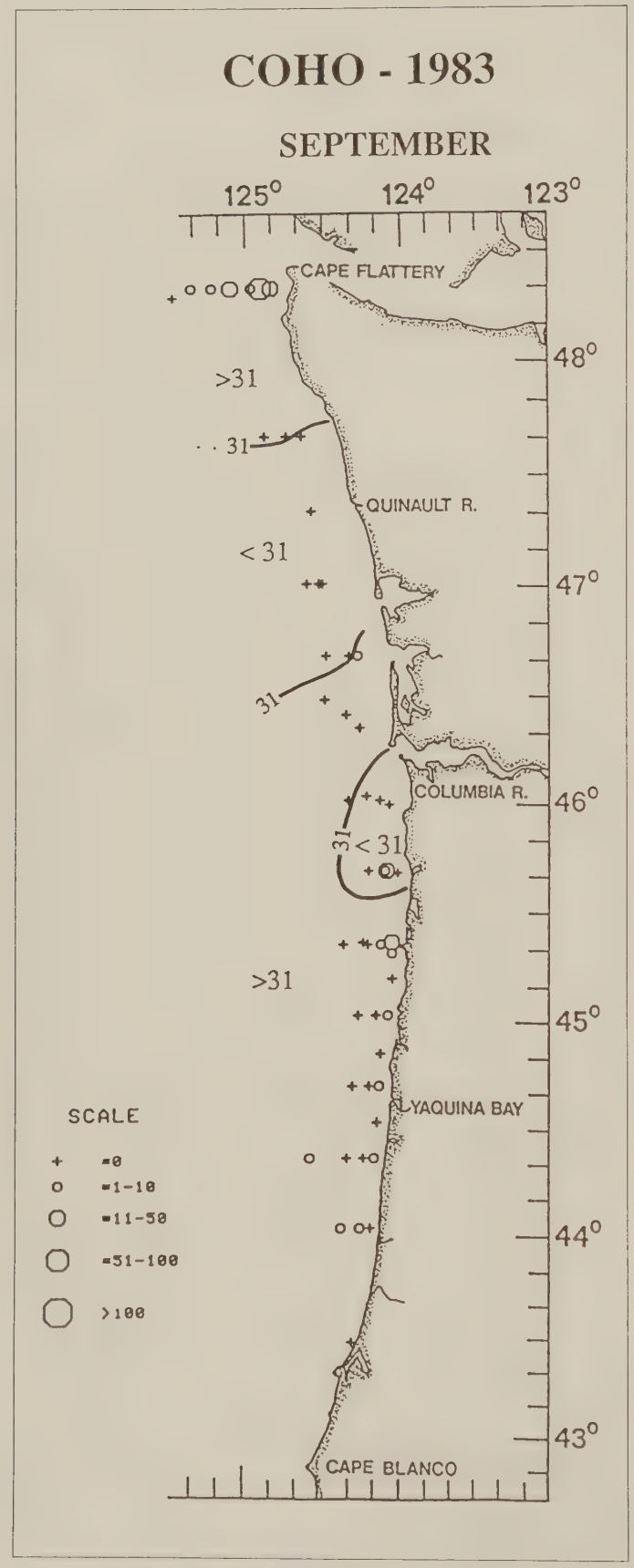
COHO - 1983
SEPTEMBER
125°
124°
123°
CAPE FLATTERY
48°
>31
31
QUINAULT R.
< 31
47°
31
COLUMBIA R.
46°
31
< 31
>31
45°
YAQUINA BAY
SCALE
+ =0
o =1-10
O =11-50
=51-100
>100
44°
43°
CAPE BLANCO

Figure 4F

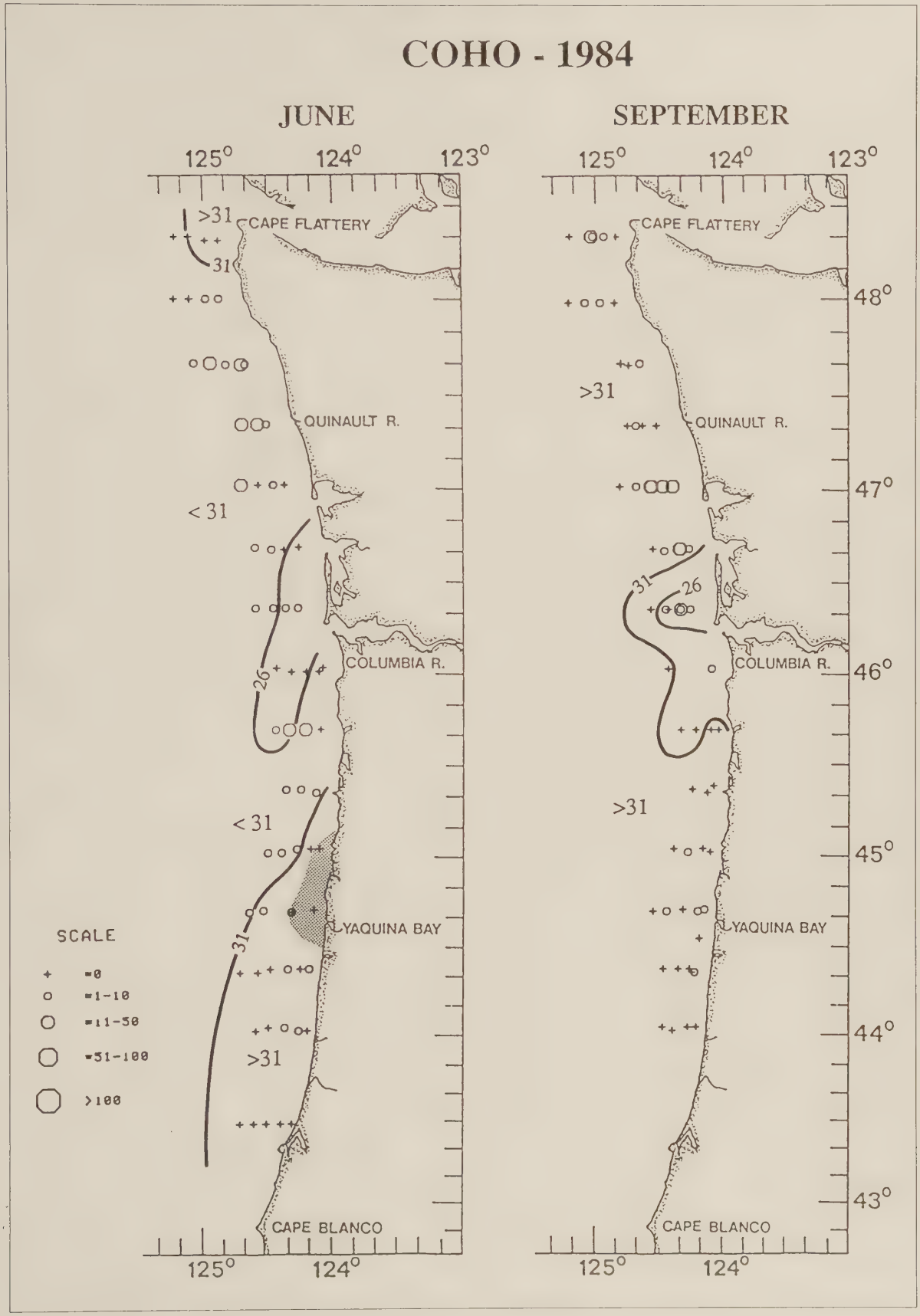
COHO - 1984
JUNE
SEPTEMBER
125°
124°
123°
48°
47°
46°
45°
44°
43°
CAPE FLATTERY
QUINAULT R.
COLUMBIA R.
YAQUINA BAY
CAPE BLANCO
>31
31
26
<31
SCALE
+ =0
o =1-10
O =11-50
=51-100
>100

Figure 4G

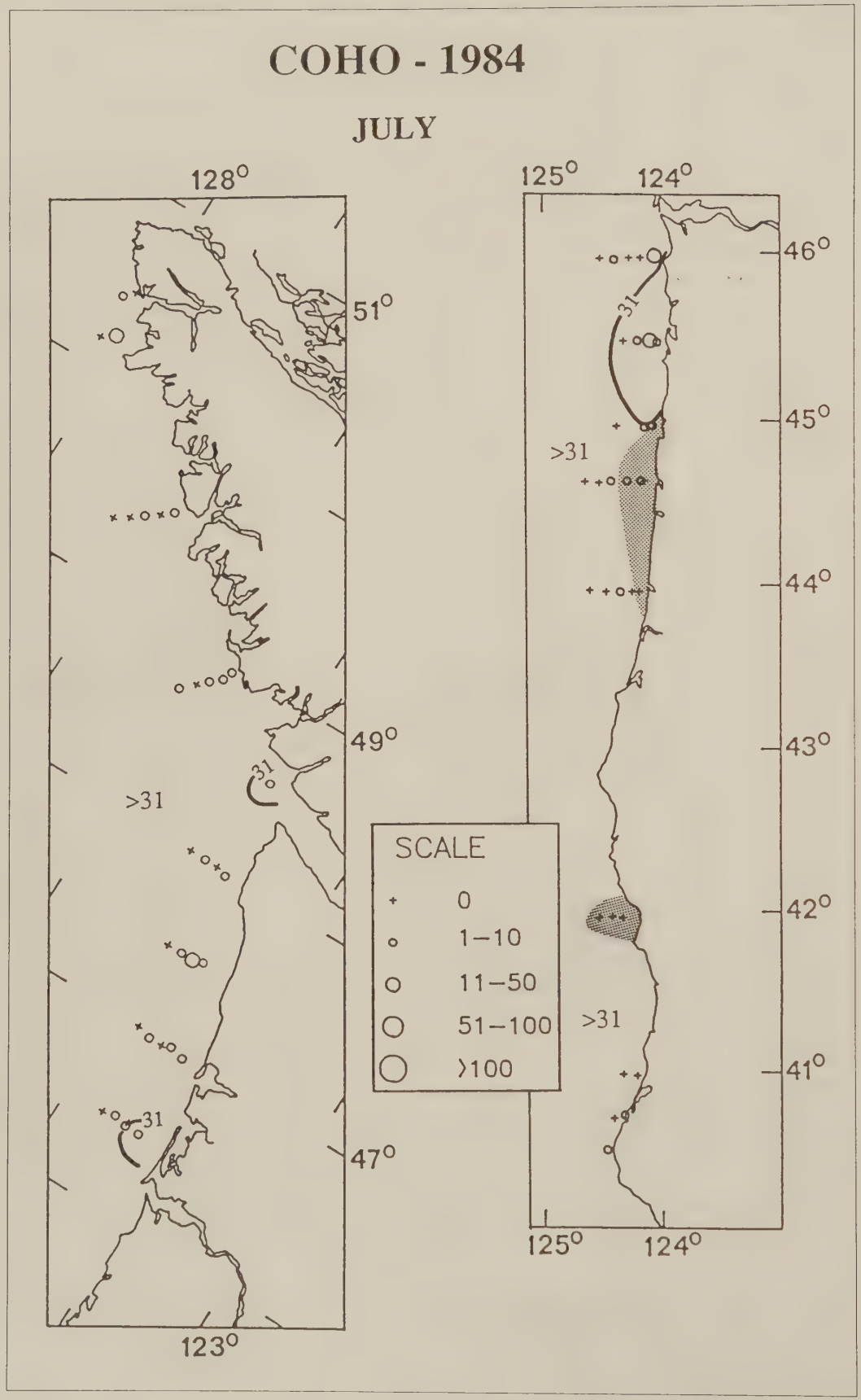
COHO - 1984
JULY
128°
125°
124°
51°
49°
47°
46°
45°
44°
43°
42°
41°
123°
>31
31
SCALE
0
1–10
11–50
51–100
>100

Figure 4H

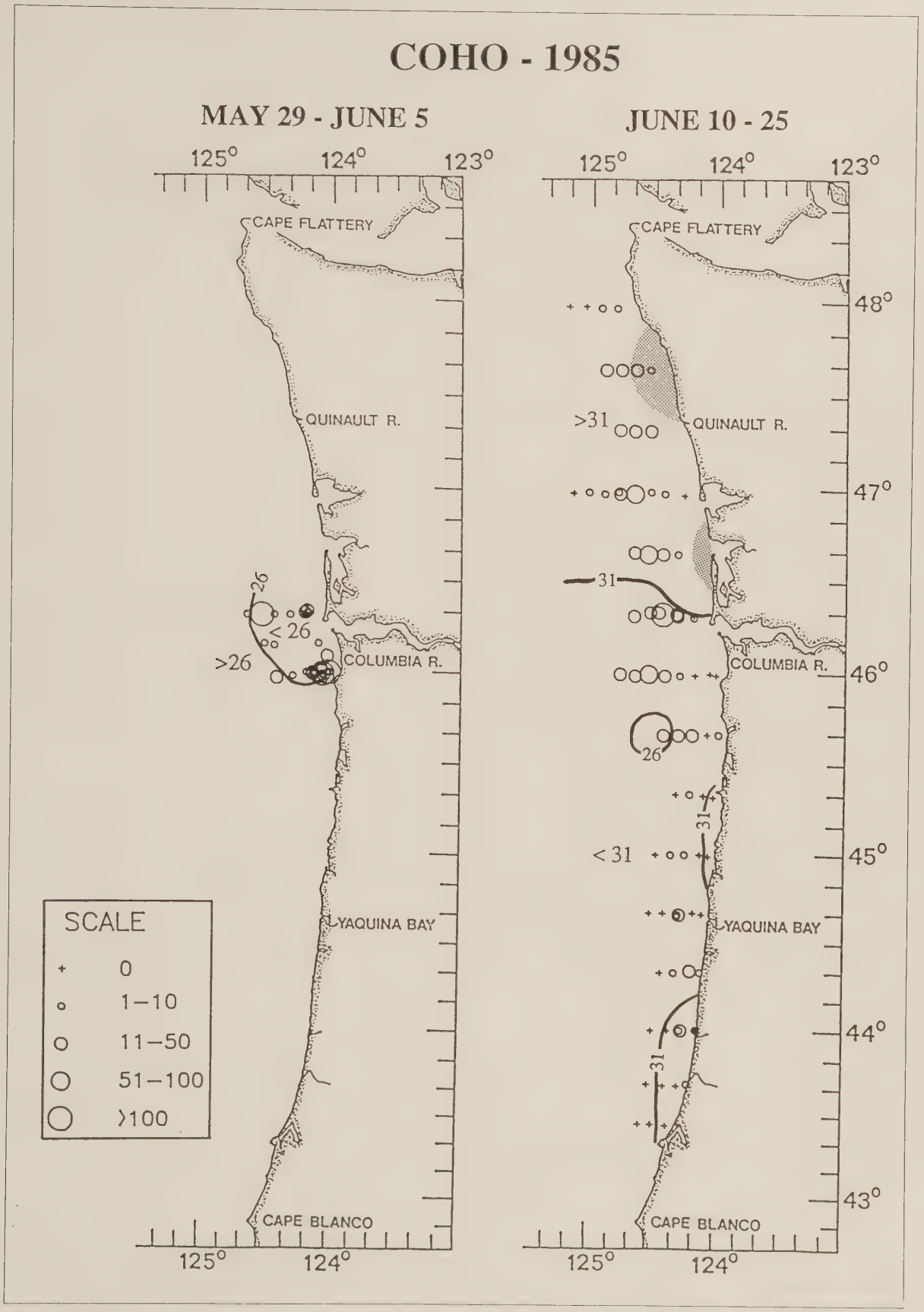
COHO - 1985
MAY 29 - JUNE 5
JUNE 10 - 25
125°
124°
123°
CAPE FLATTERY
QUINAULT R.
COLUMBIA R.
YAQUINA BAY
CAPE BLANCO
48°
47°
46°
45°
44°
43°
>31
31
26
>26
< 26
< 31
SCALE
0
1–10
11–50
51–100
>100

Figure 4I

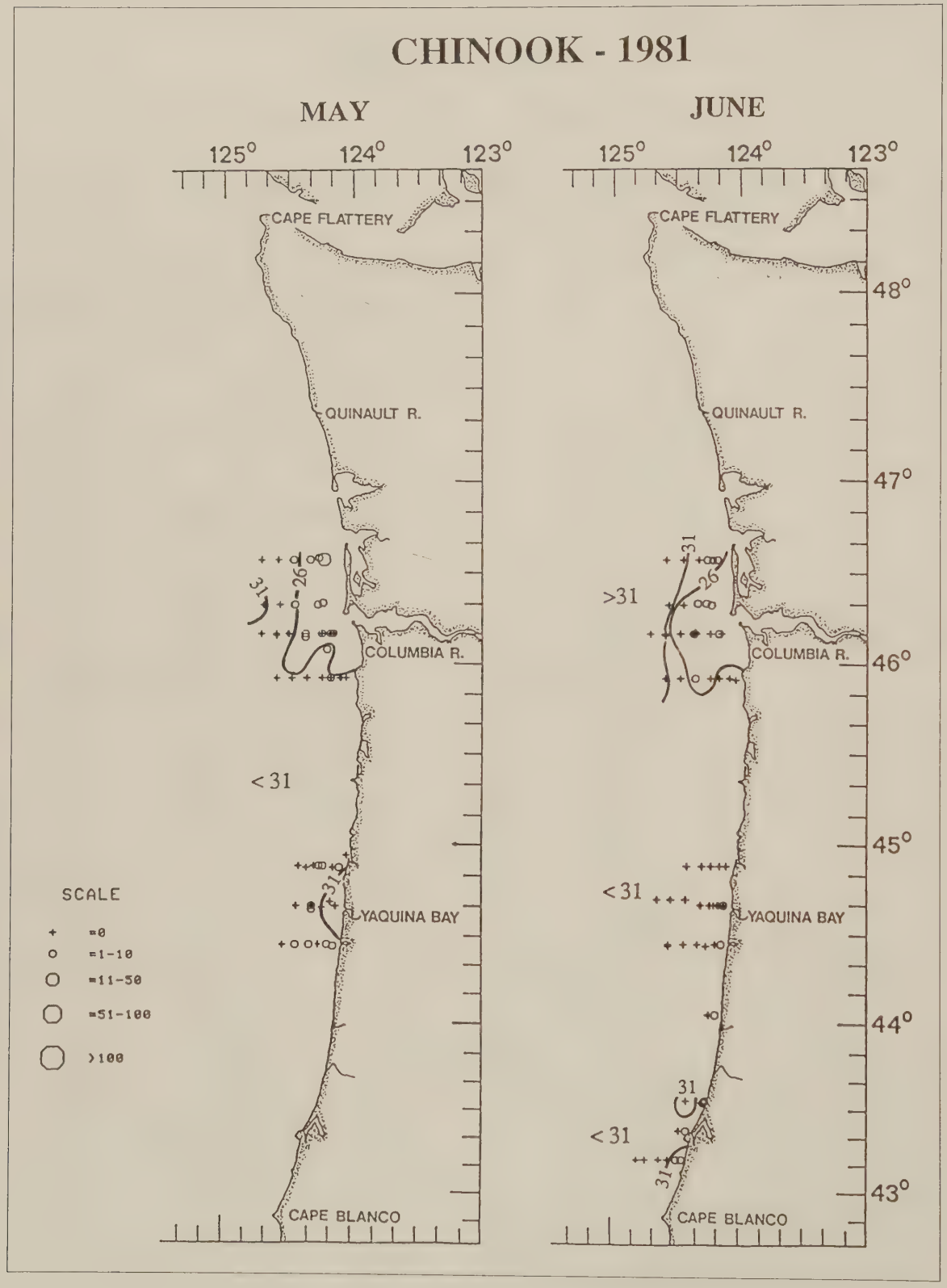

Figure 5A

Catch distribution of juvenile chinook salmon off Oregon and Washington for each cruise. Sampling was extended to British Columbia and California in 1984. The 26 and 32‰ surface isohaline lines are also indicated as well as areas where the surface temperature was ≤10.0 °C (shaded).

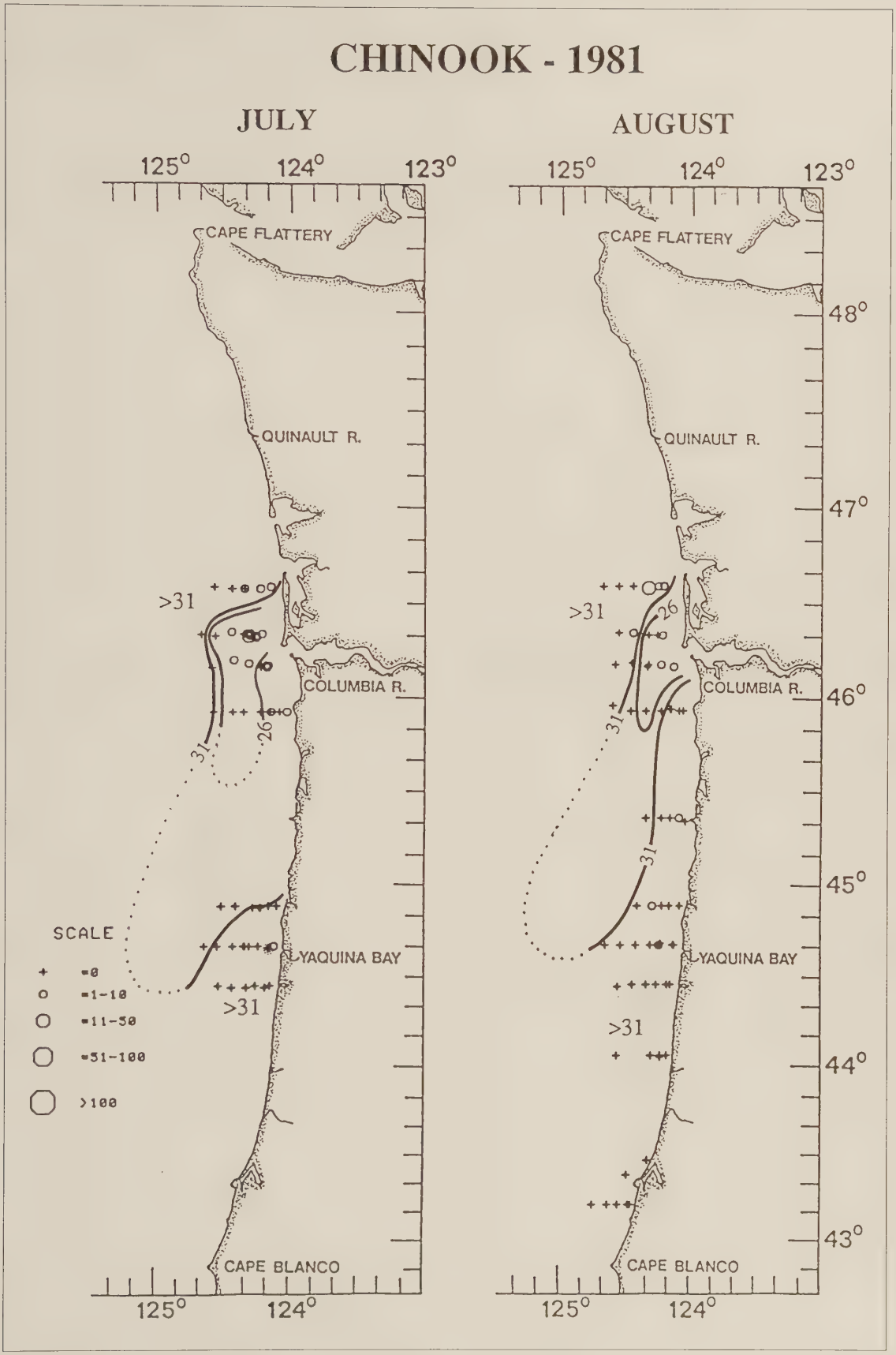
CHINOOK - 1981
JULY
AUGUST
125°
124°
123°
CAPE FLATTERY
QUINAULT R.
COLUMBIA R.
YAQUINA BAY
CAPE BLANCO
48°
47°
46°
45°
44°
43°
>31
31
26
SCALE
+ =0
o =1-10
O =11-50
O =51-100
O >100

Figure 5B

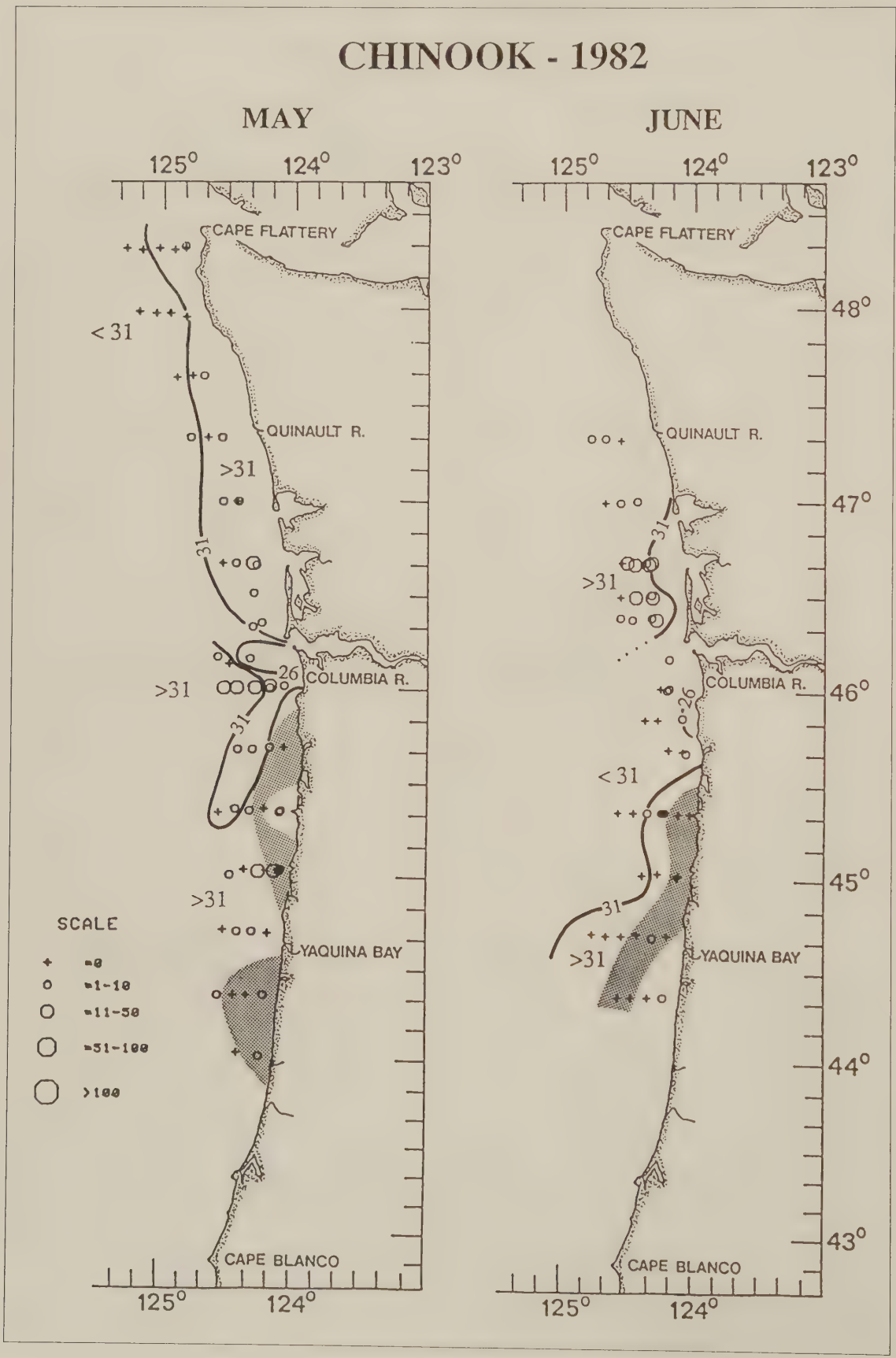
CHINOOK - 1982
MAY
JUNE
125°
124°
123°
CAPE FLATTERY
QUINAULT R.
COLUMBIA R.
YAQUINA BAY
CAPE BLANCO
48°
47°
46°
45°
44°
43°
<31
>31
31
26
SCALE
=0
=1-10
=11-50
=51-100
>100

Figure 5C

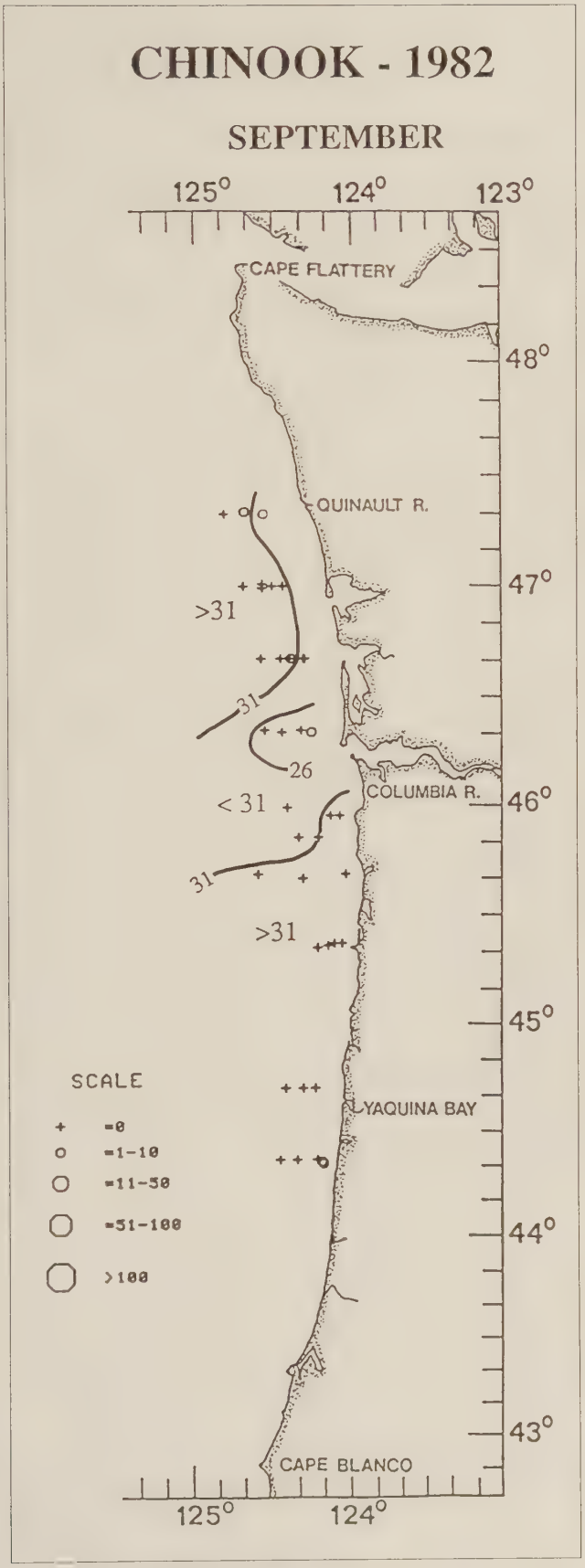
CHINOOK - 1982
SEPTEMBER
125°
124°
123°
CAPE FLATTERY
48°
QUINAULT R.
47°
>31
31
26
< 31
COLUMBIA R.
46°
31
>31
45°
SCALE
+ =0
o =1-10
=11-50
=51-100
>100
YAQUINA BAY
44°
43°
CAPE BLANCO
125°
124°

Figure 5D

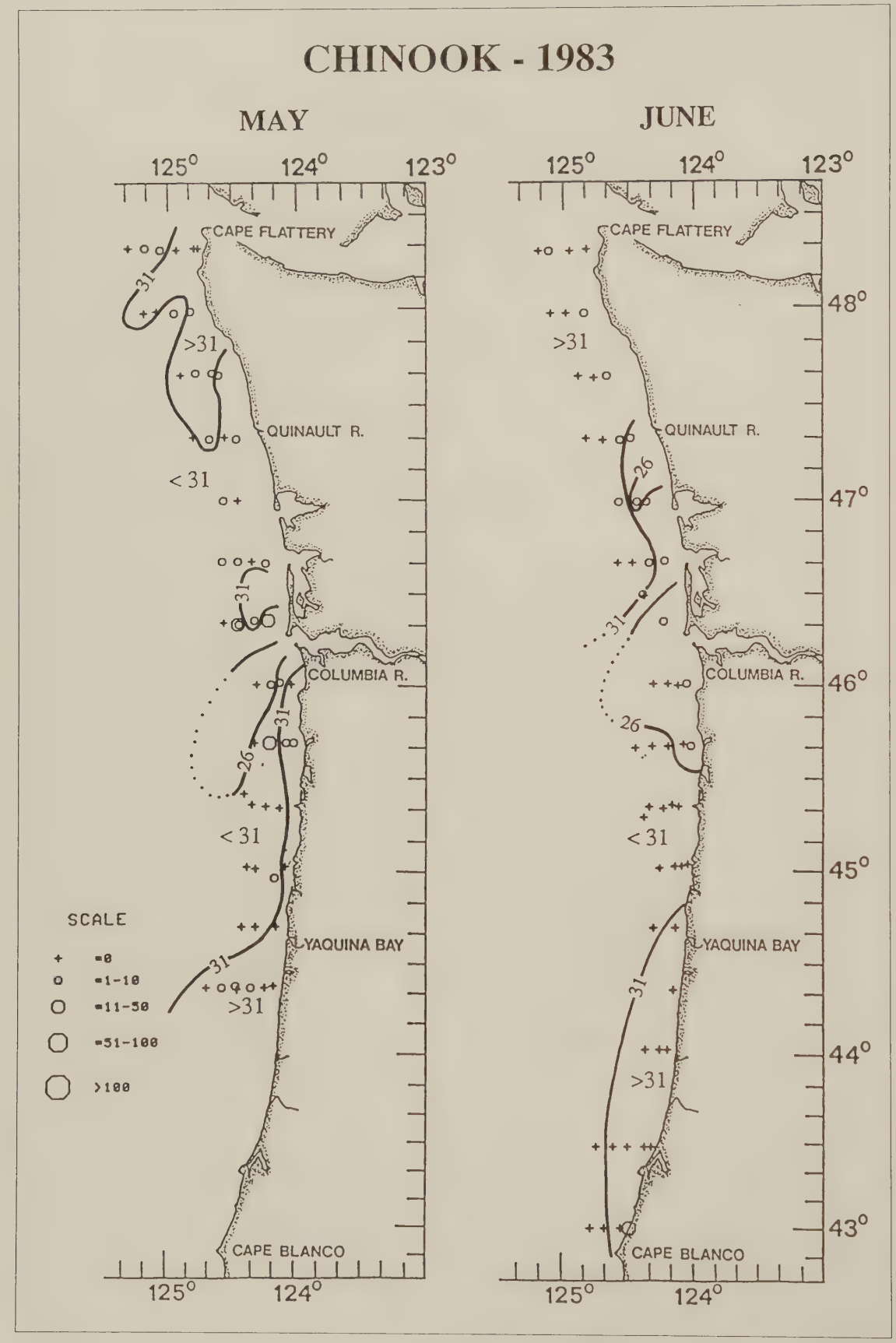
CHINOOK - 1983
MAY
JUNE
125°
124°
123°
48°
47°
46°
45°
44°
43°
CAPE FLATTERY
QUINAULT R.
COLUMBIA R.
YAQUINA BAY
CAPE BLANCO
>31
<31
31
26
SCALE
+ =0
o =1-10
O =11-50
⬡ =51-100
⬢ >100

Figure 5E

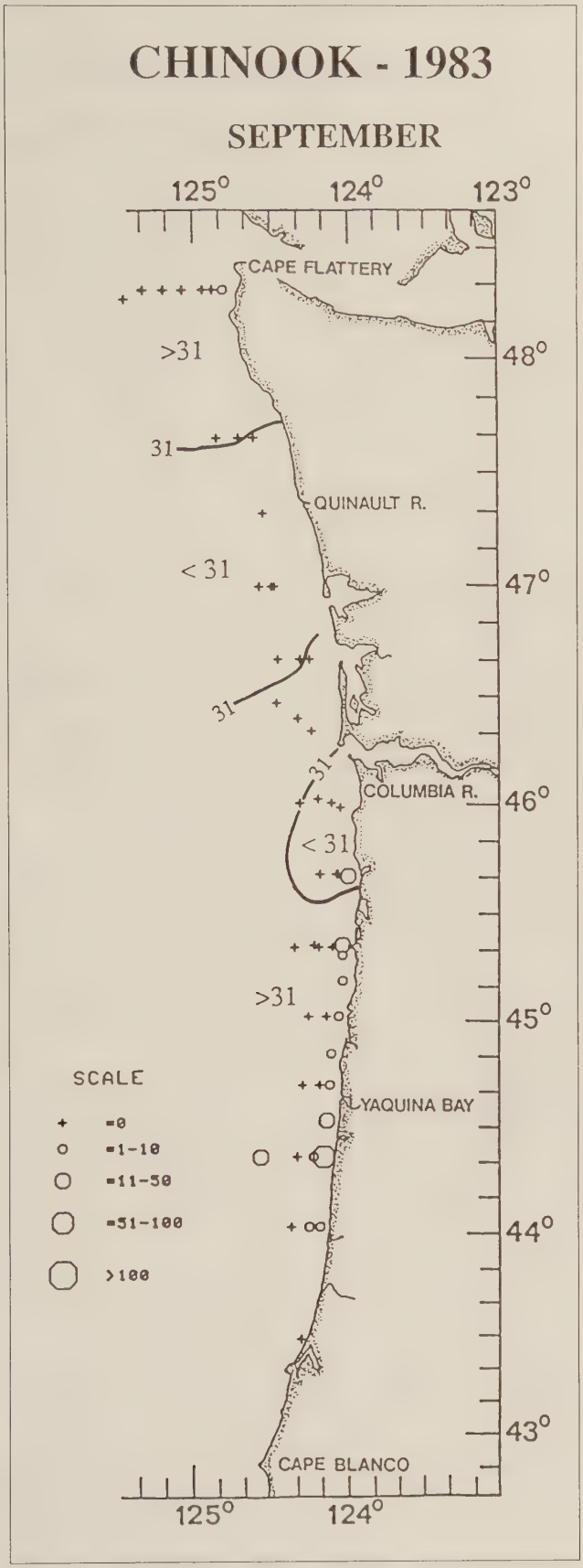
CHINOOK - 1983
SEPTEMBER
125°
124°
123°
CAPE FLATTERY
>31
48°
31
QUINAULT R.
< 31
47°
31
31
COLUMBIA R.
46°
< 31
>31
45°
SCALE
+ =0
o =1-10
O =11-50
O =51-100
O >100
YAQUINA BAY
44°
43°
CAPE BLANCO
125°
124°

Figure 5F

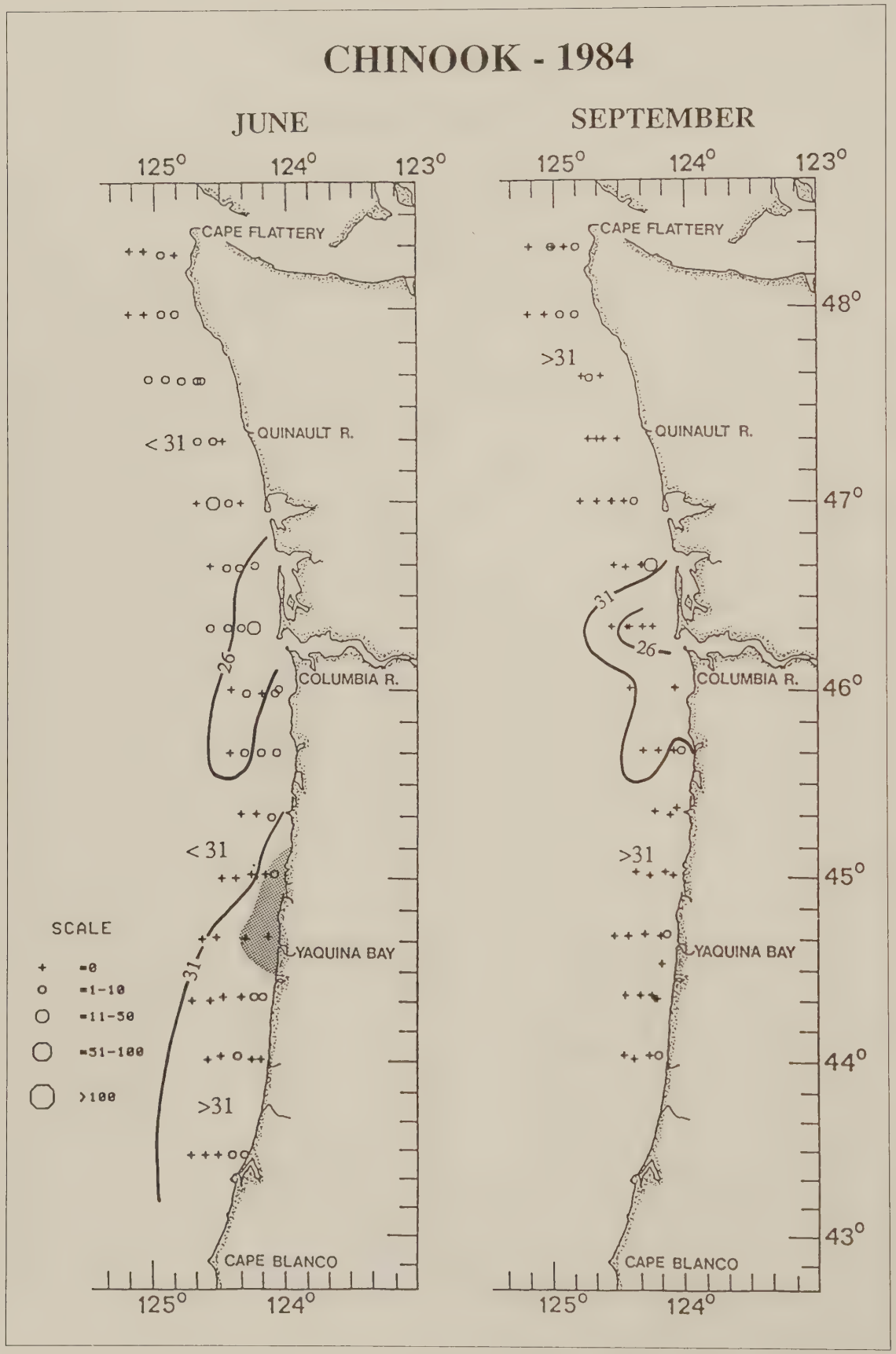
CHINOOK - 1984
JUNE
SEPTEMBER
125°
124°
123°
CAPE FLATTERY
QUINAULT R.
COLUMBIA R.
YAQUINA BAY
CAPE BLANCO
48°
47°
46°
45°
44°
43°
< 31
>31
26
31
SCALE
+ =0
o =1-10
O =11-50
=51-100
>100

Figure 5G

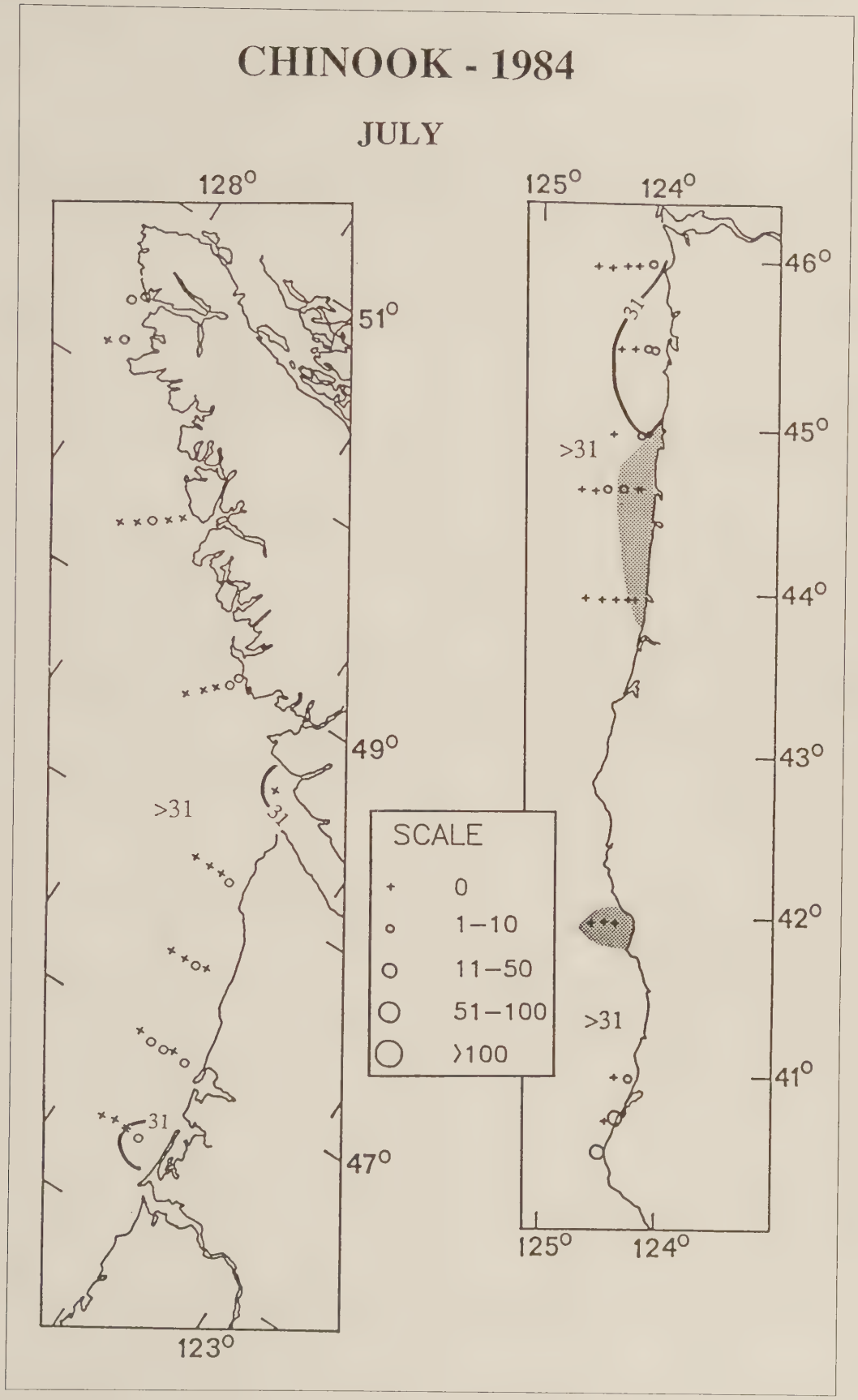
CHINOOK - 1984
JULY
128°
125°
124°
51°
49°
47°
46°
45°
44°
43°
42°
41°
123°
>31
31
SCALE
0
1–10
11–50
51–100
>100

Figure 5H

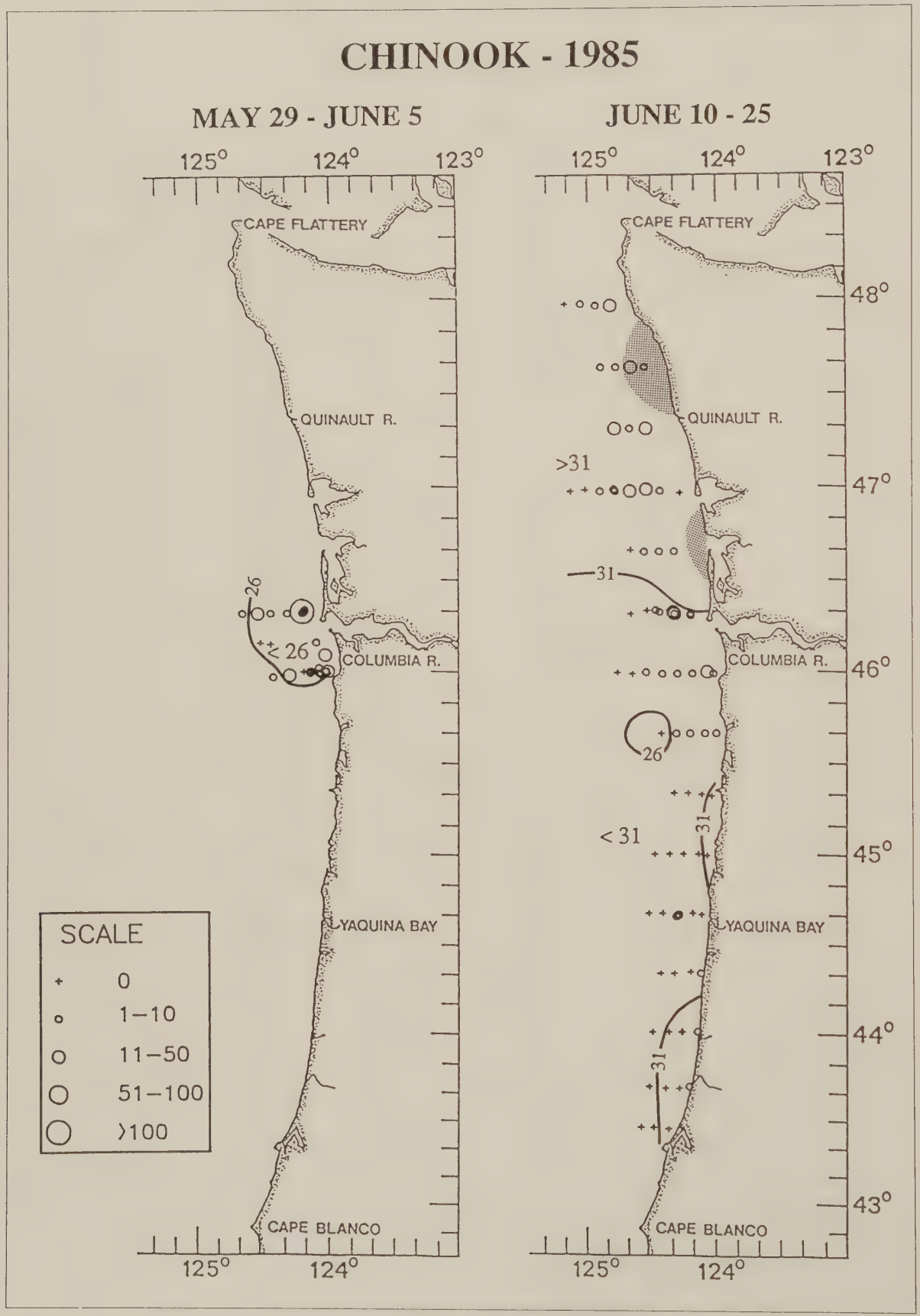
CHINOOK - 1985
MAY 29 - JUNE 5
JUNE 10 - 25
125°
124°
123°
CAPE FLATTERY
QUINAULT R.
COLUMBIA R.
YAQUINA BAY
CAPE BLANCO
48°
47°
46°
45°
44°
43°
26
< 26
>31
31
< 31
SCALE
0
1–10
11–50
51–100
>100

Figure 5I

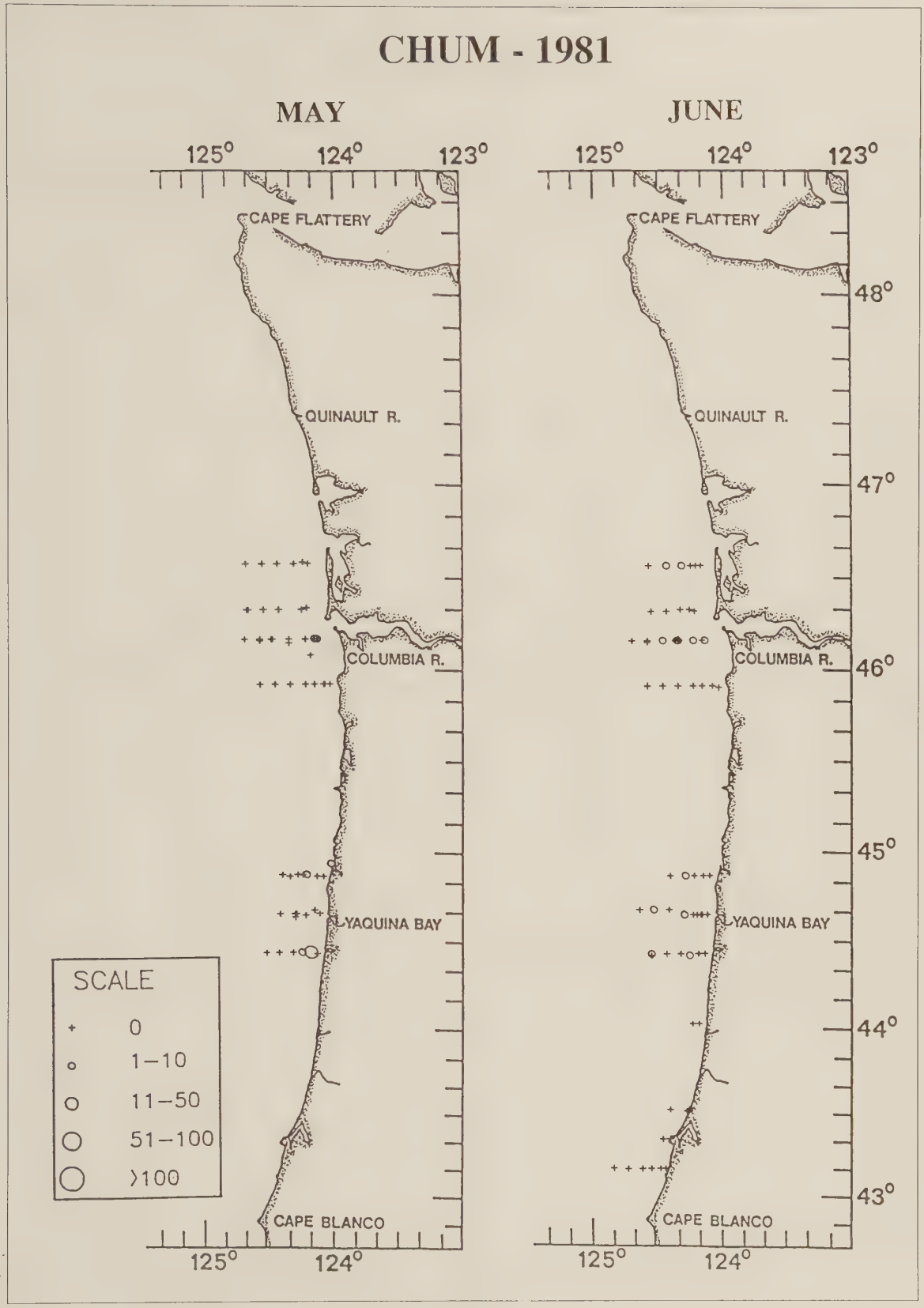

Figure 6A

Catch distribution of juvenile chum salmon off Oregon and Washington for each cruise. Sampling was extended to British Columbia and California in 1984.

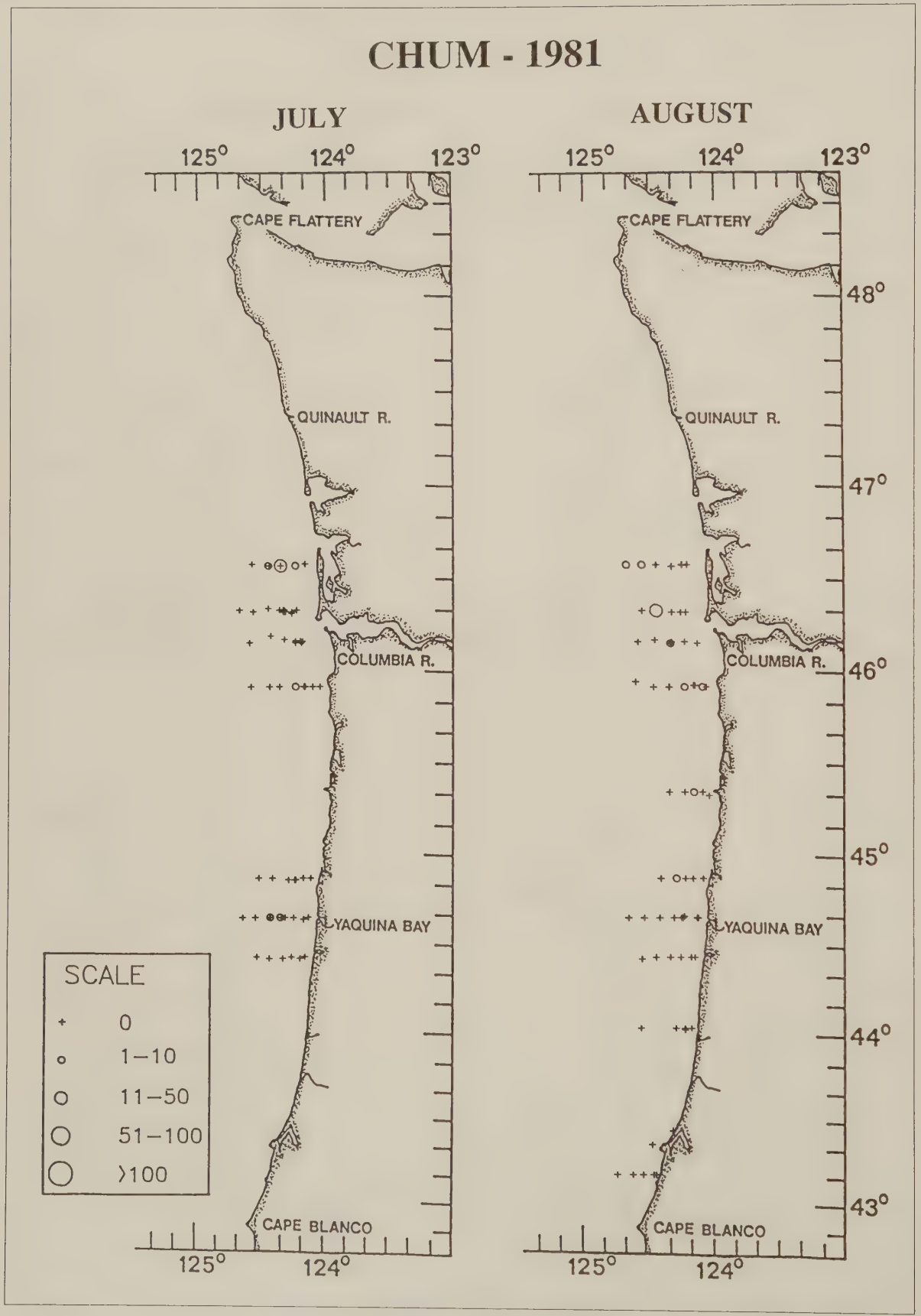
CHUM - 1981
JULY
AUGUST
125°
124°
123°
CAPE FLATTERY
QUINAULT R.
COLUMBIA R.
YAQUINA BAY
CAPE BLANCO
48°
47°
46°
45°
44°
43°
SCALE
0
1–10
11–50
51–100
>100

Figure 6B

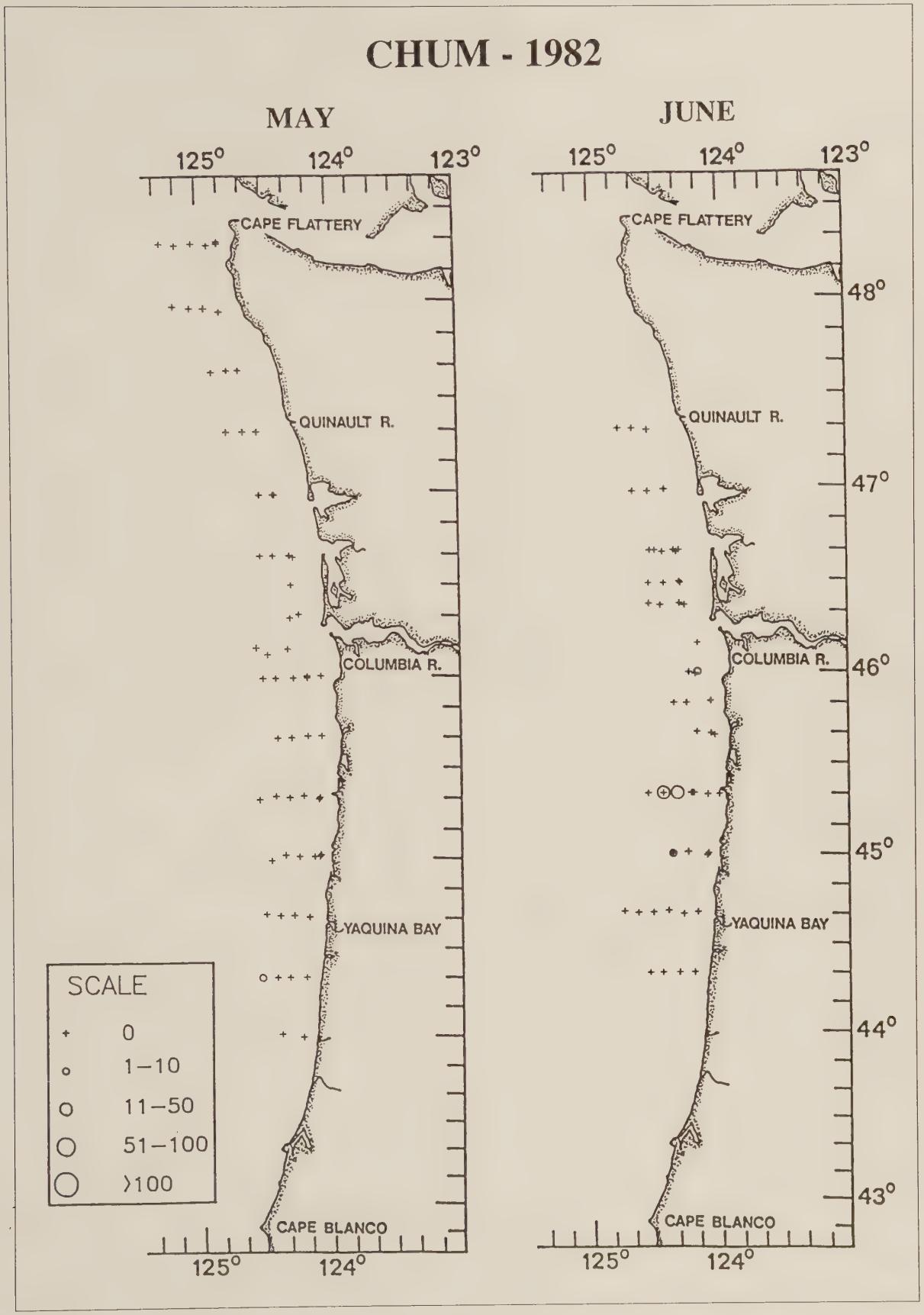
CHUM - 1982
MAY
JUNE
125°
124°
123°
CAPE FLATTERY
QUINAULT R.
COLUMBIA R.
YAQUINA BAY
CAPE BLANCO
48°
47°
46°
45°
44°
43°
SCALE
0
1–10
11–50
51–100
>100

Figure 6C

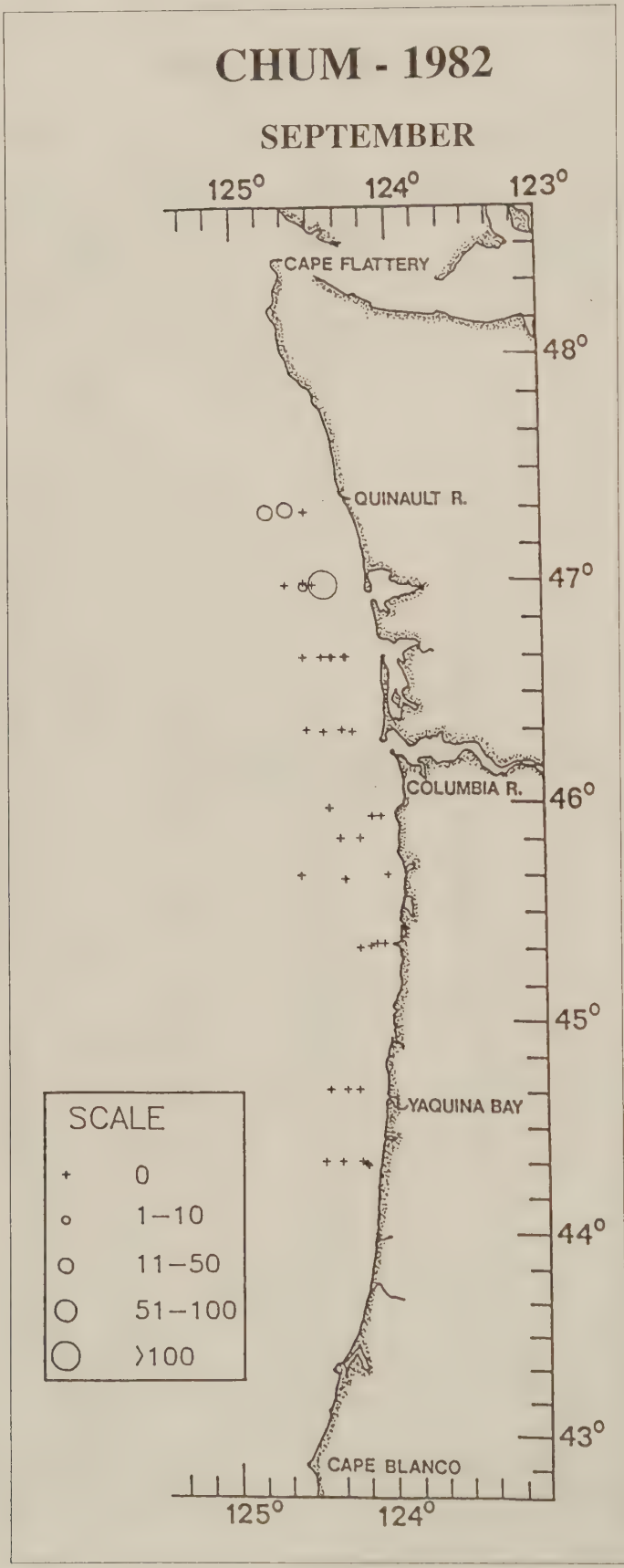
CHUM - 1982
SEPTEMBER
125°
124°
123°
CAPE FLATTERY
48°
QUINAULT R.
47°
COLUMBIA R.
46°
45°
YAQUINA BAY
44°
43°
CAPE BLANCO
125°
124°
SCALE
0
1–10
11–50
51–100
>100

Figure 6D

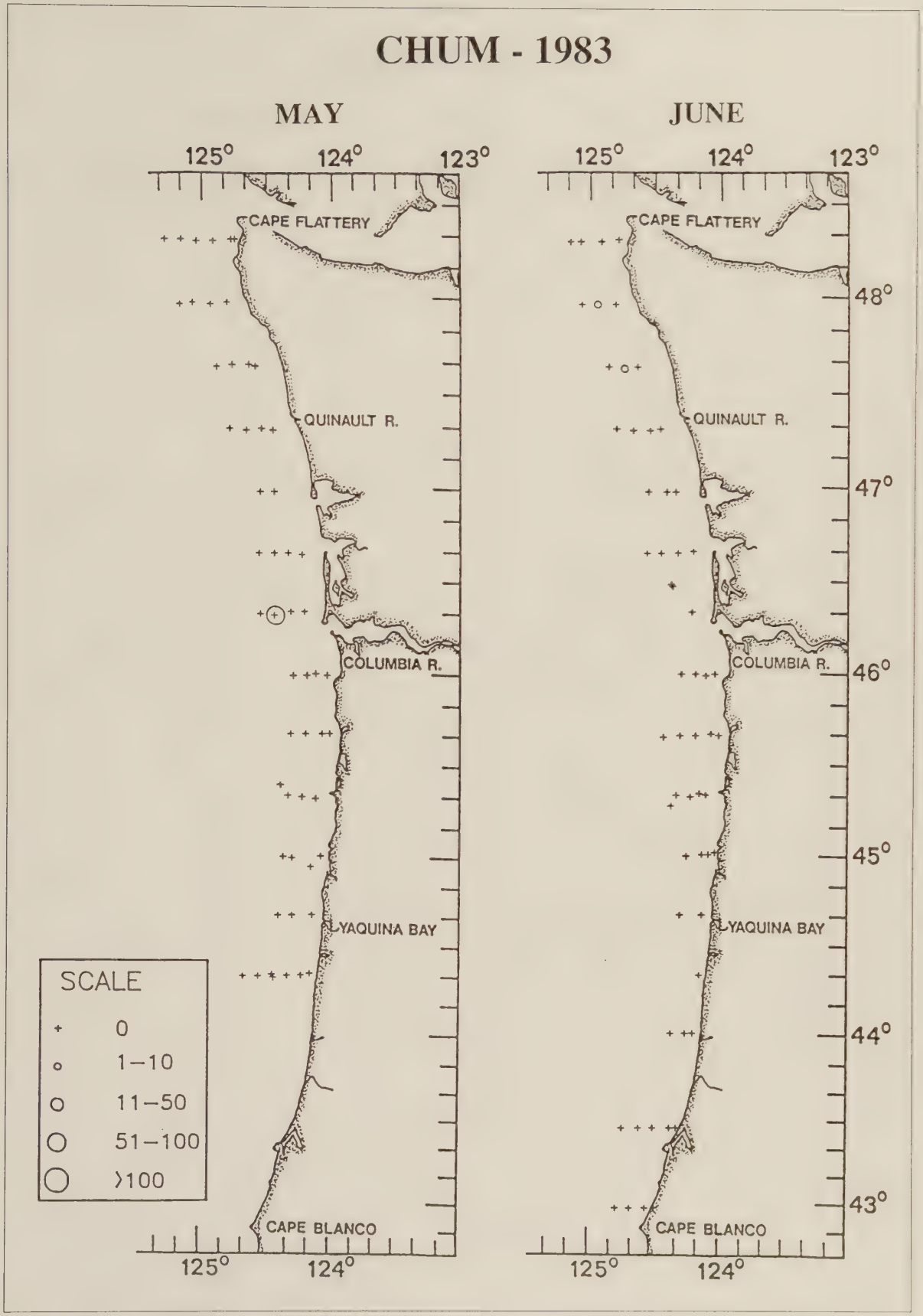
CHUM - 1983
MAY
JUNE
125°
124°
123°
CAPE FLATTERY
QUINAULT R.
COLUMBIA R.
YAQUINA BAY
CAPE BLANCO
48°
47°
46°
45°
44°
43°
SCALE
0
1–10
11–50
51–100
>100

Figure 6E

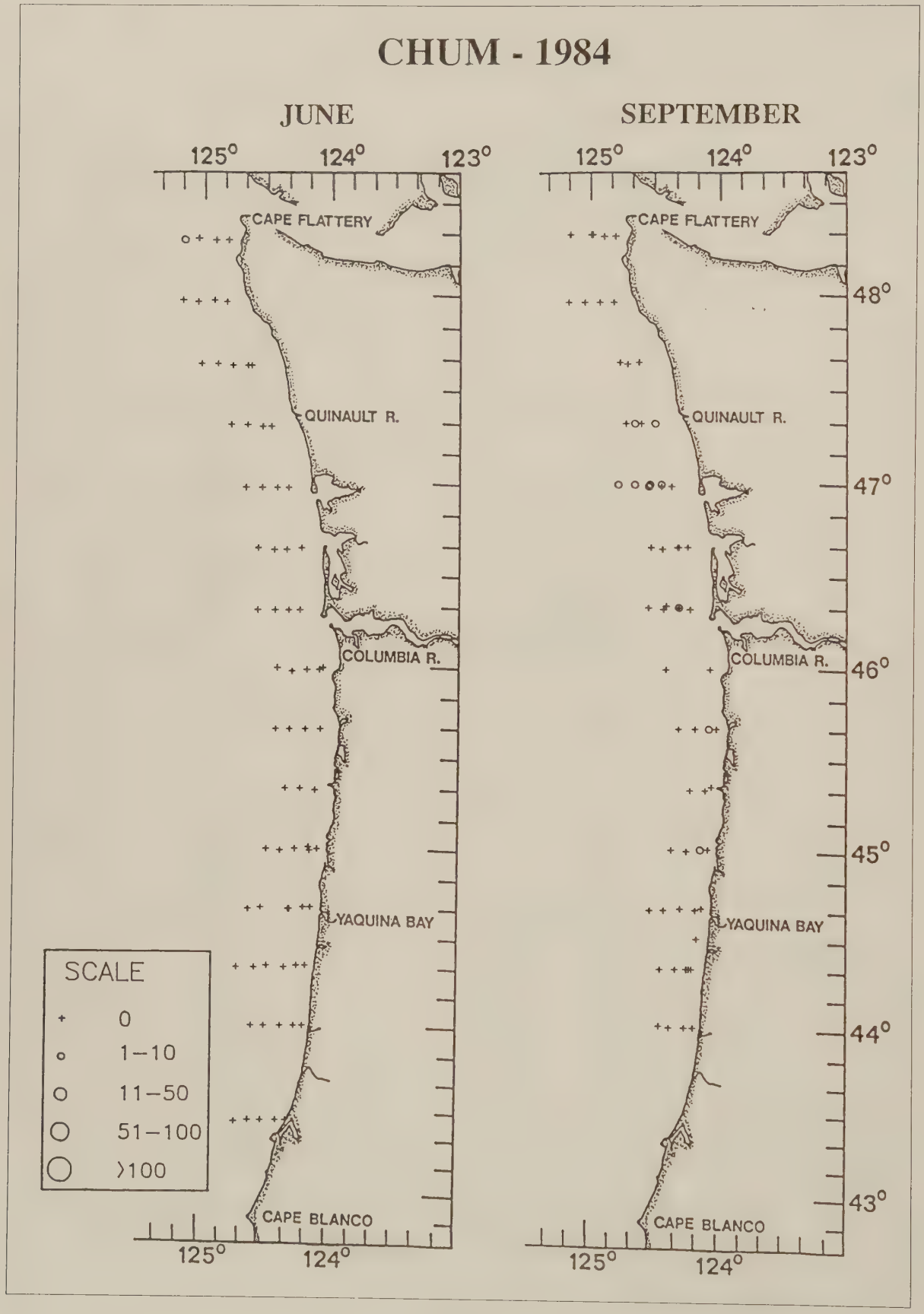
CHUM - 1984
JUNE
SEPTEMBER
125°
124°
123°
CAPE FLATTERY
QUINAULT R.
COLUMBIA R.
YAQUINA BAY
CAPE BLANCO
48°
47°
46°
45°
44°
43°
SCALE
0
1–10
11–50
51–100
>100

Figure 6F

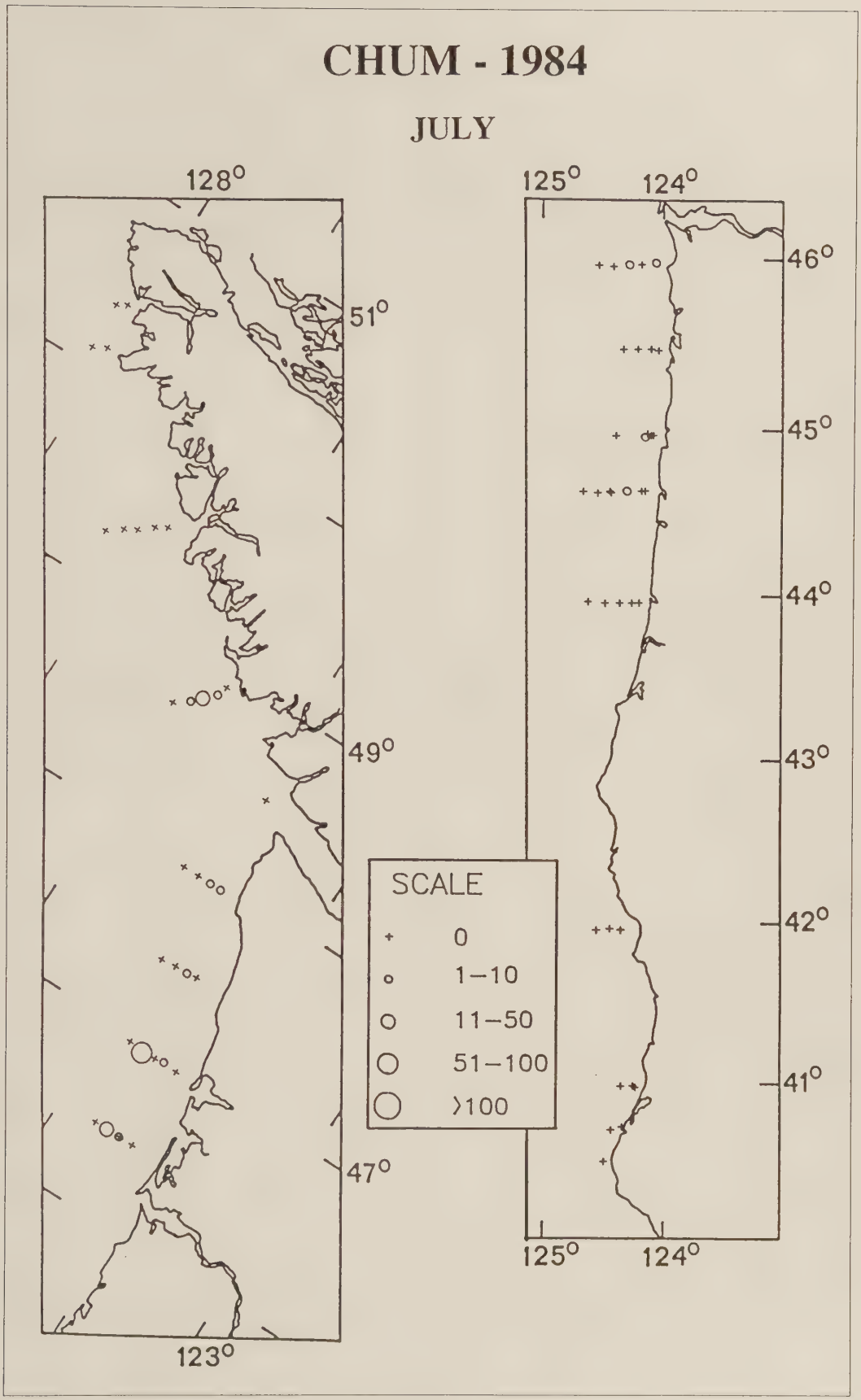
CHUM - 1984
JULY
128°
125°
124°
51°
49°
47°
46°
45°
44°
43°
42°
41°
123°
SCALE
0
1–10
11–50
51–100
>100

Figure 6G

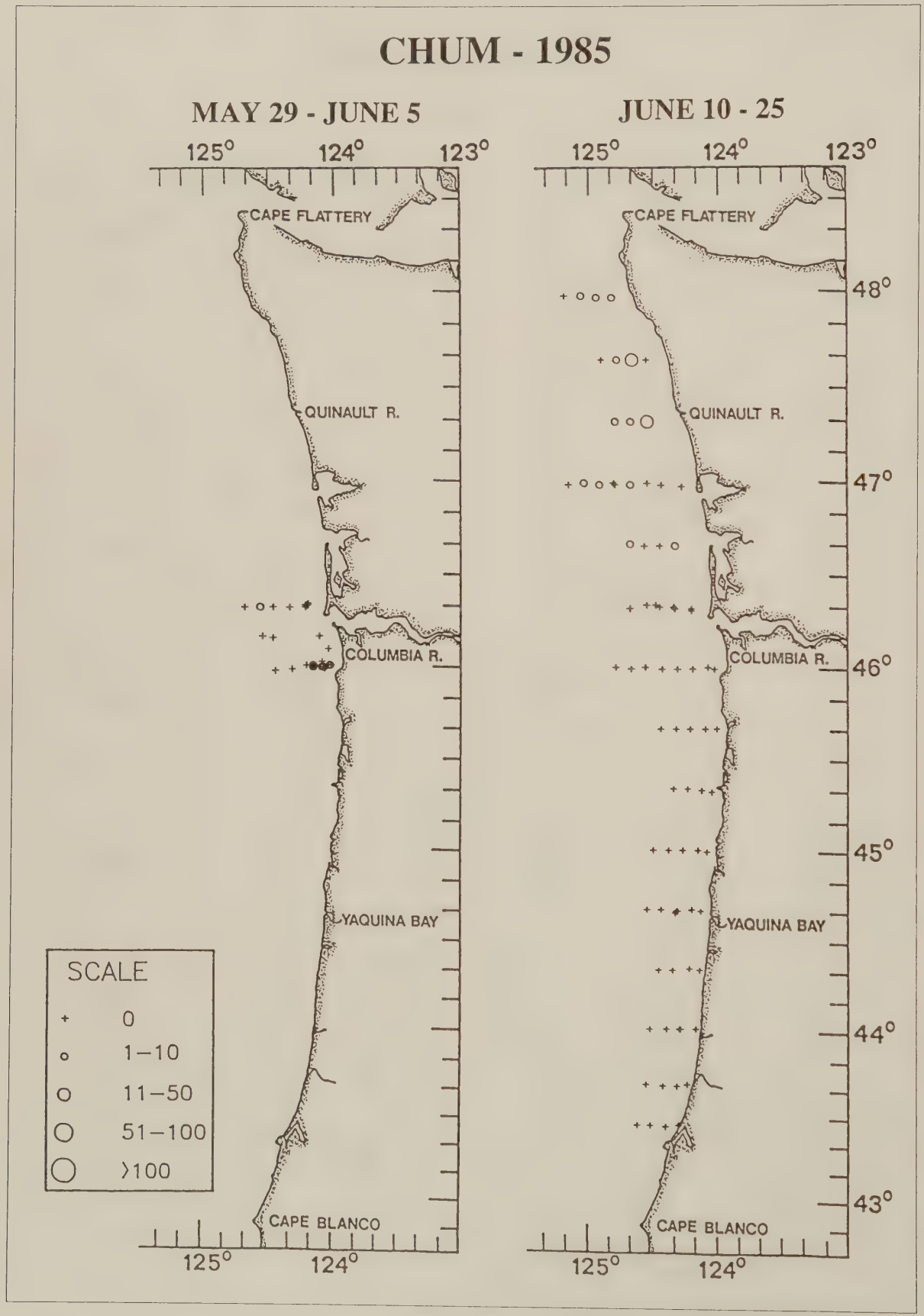
CHUM - 1985
MAY 29 - JUNE 5
JUNE 10 - 25
125°
124°
123°
CAPE FLATTERY
QUINAULT R.
COLUMBIA R.
YAQUINA BAY
CAPE BLANCO
48°
47°
46°
45°
44°
43°
SCALE
0
1–10
11–50
51–100
>100

Figure 6H

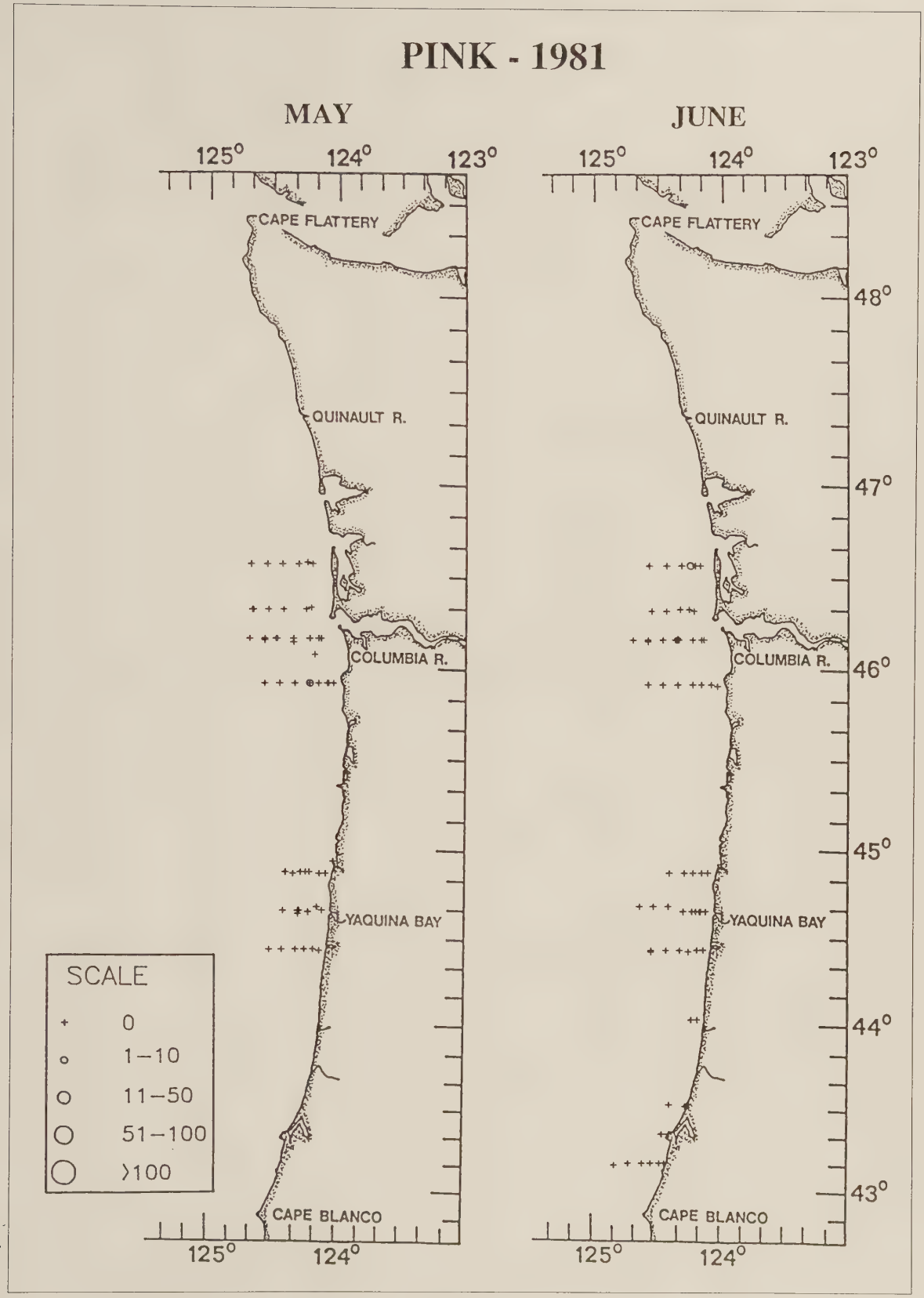

Figure 7A

Catch distribution of juvenile pink salmon off Oregon and Washington for each cruise. Sampling was extended to British Columbia and California in 1984.

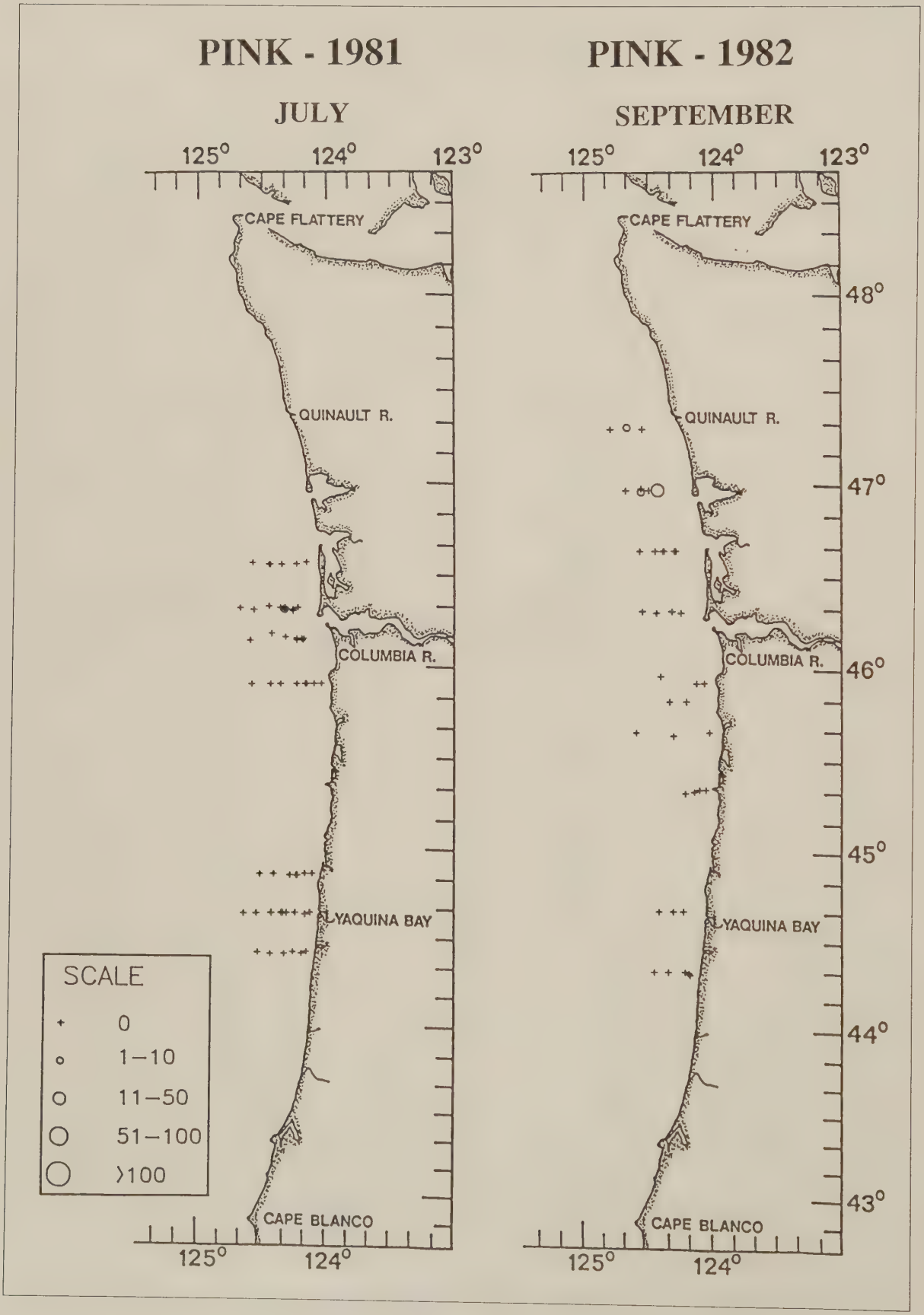
PINK - 1981
JULY
PINK - 1982
SEPTEMBER
125°
124°
123°
CAPE FLATTERY
QUINAULT R.
COLUMBIA R.
YAQUINA BAY
CAPE BLANCO
48°
47°
46°
45°
44°
43°
SCALE
0
1–10
11–50
51–100
>100

Figure 7B

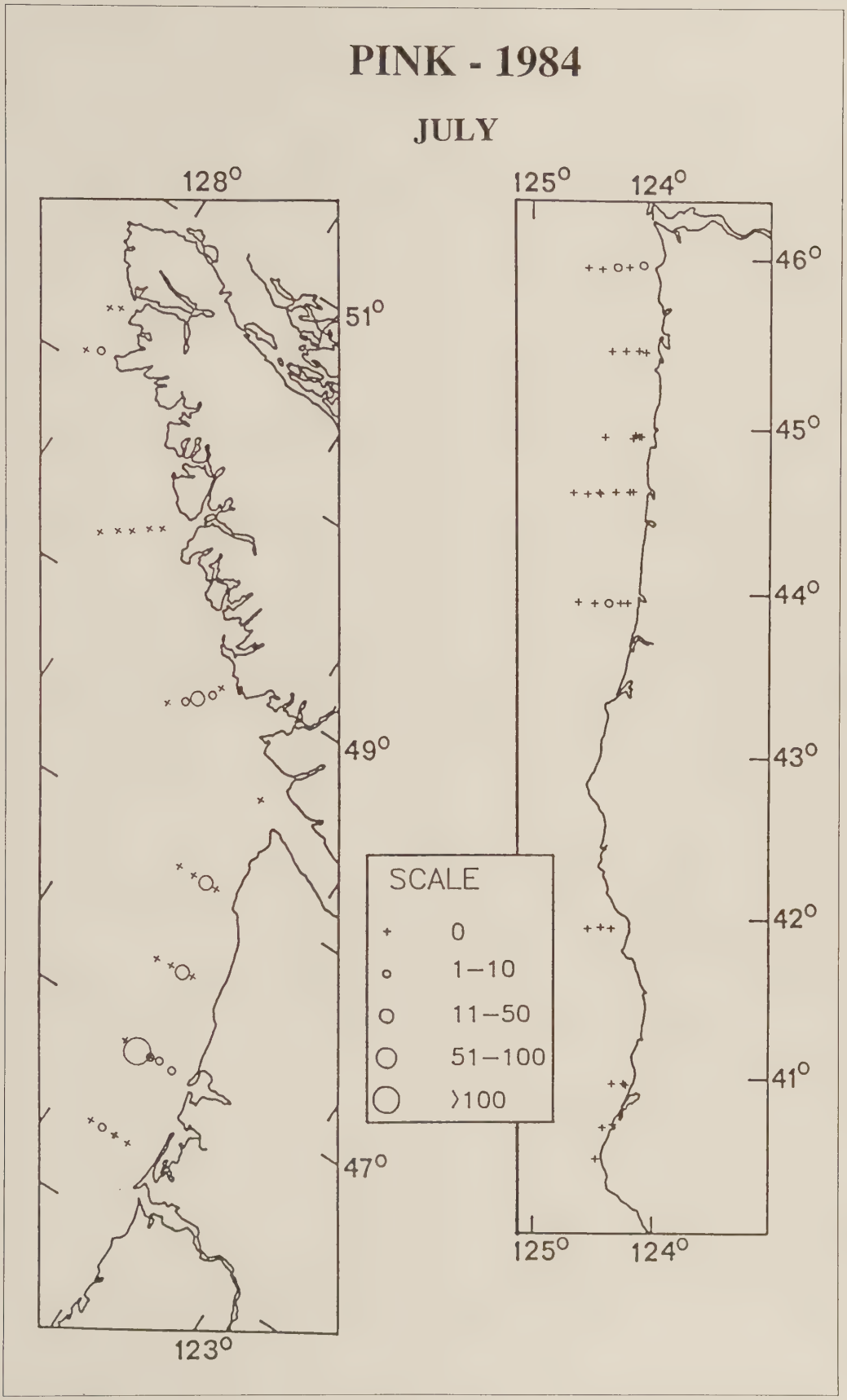
PINK - 1984
JULY
128°
125°
124°
51°
49°
47°
46°
45°
44°
43°
42°
41°
123°
SCALE
0
1–10
11–50
51–100
>100

Figure 7C

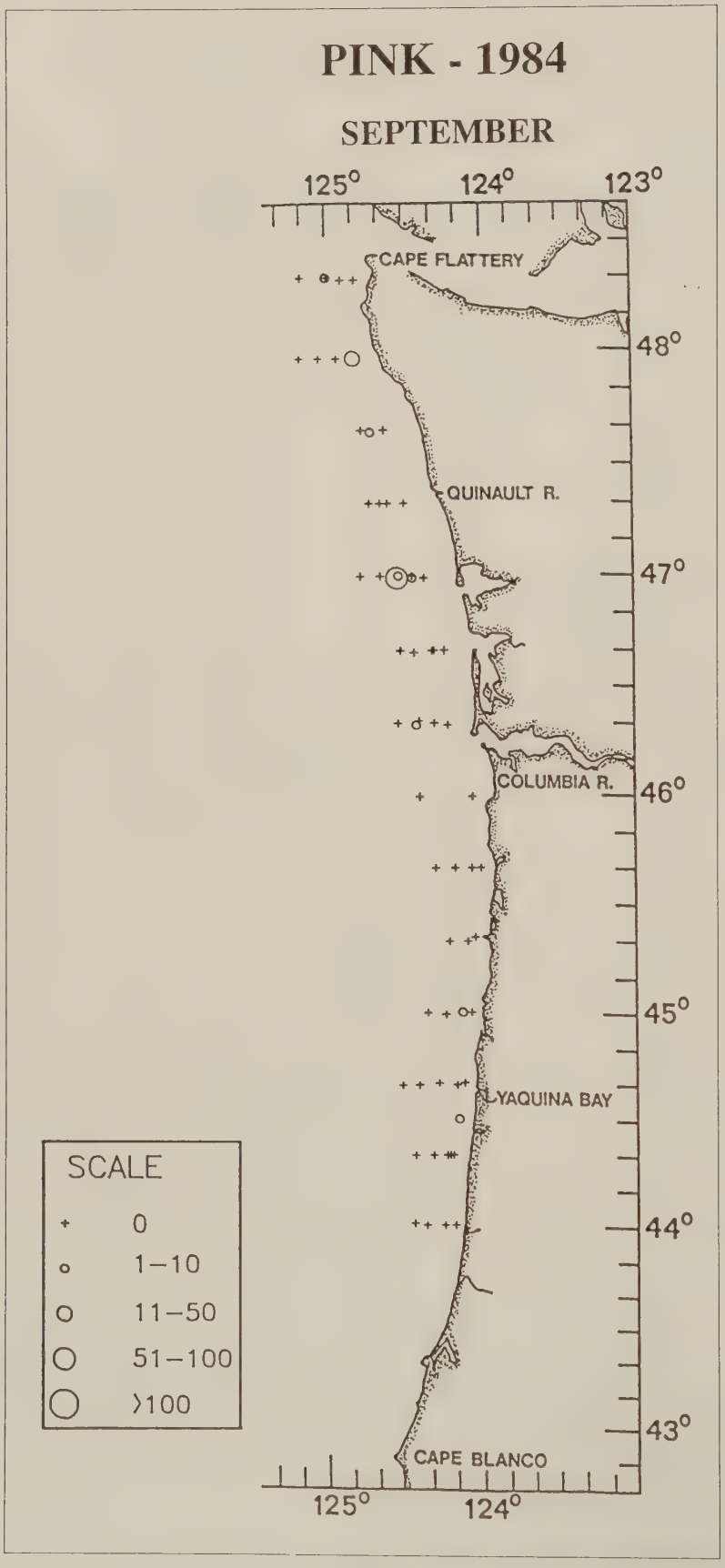
PINK - 1984
SEPTEMBER
125°
124°
123°
CAPE FLATTERY
48°
QUINAULT R.
47°
COLUMBIA R.
46°
45°
YAQUINA BAY
44°
43°
CAPE BLANCO
125°
124°
SCALE
0
1–10
11–50
51–100
>100

Figure 7D

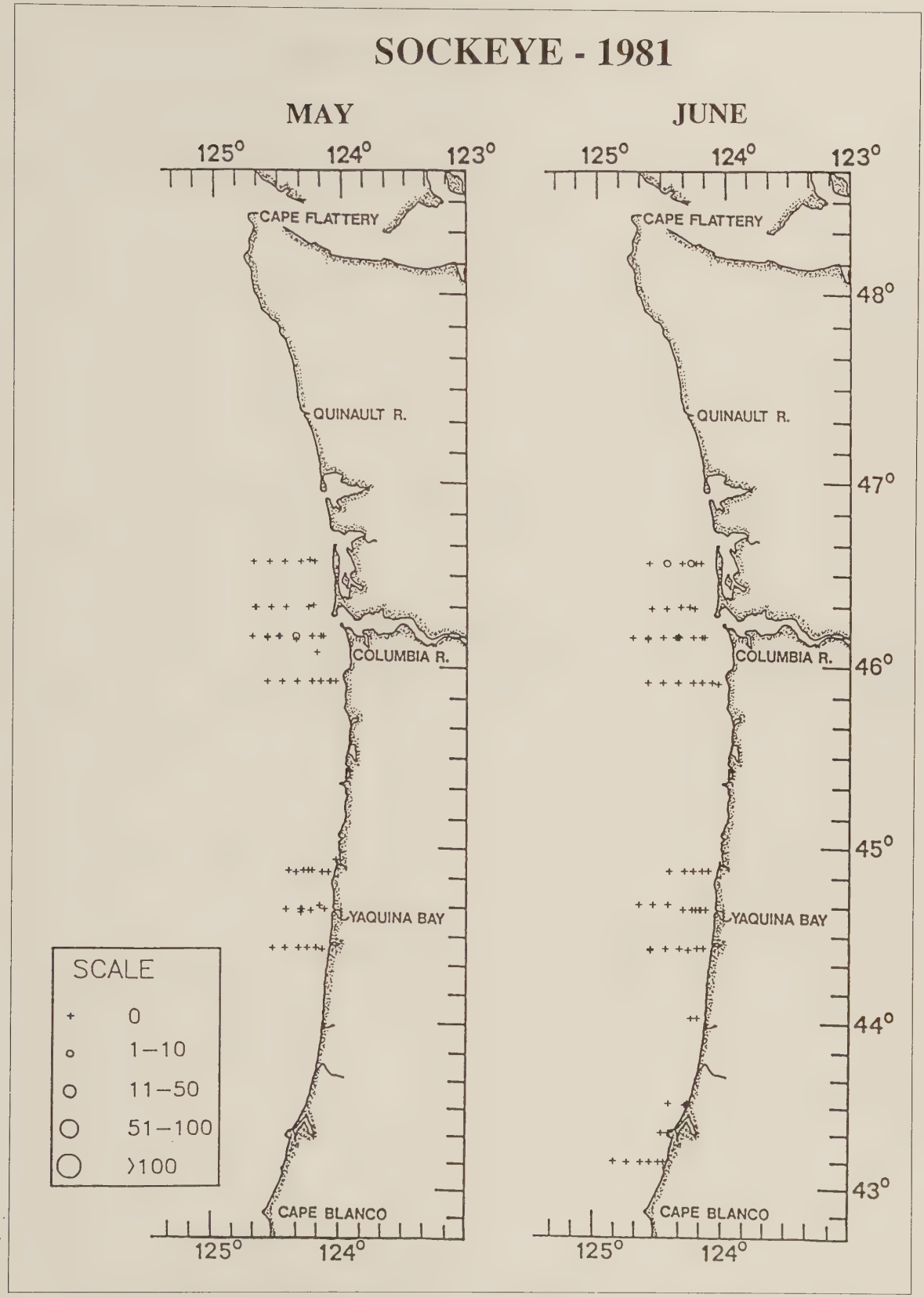

Figure 8A

Catch distribution of juvenile sockeye salmon off Oregon and Washington for each cruise. Sampling was extended to British Columbia and California in 1984.

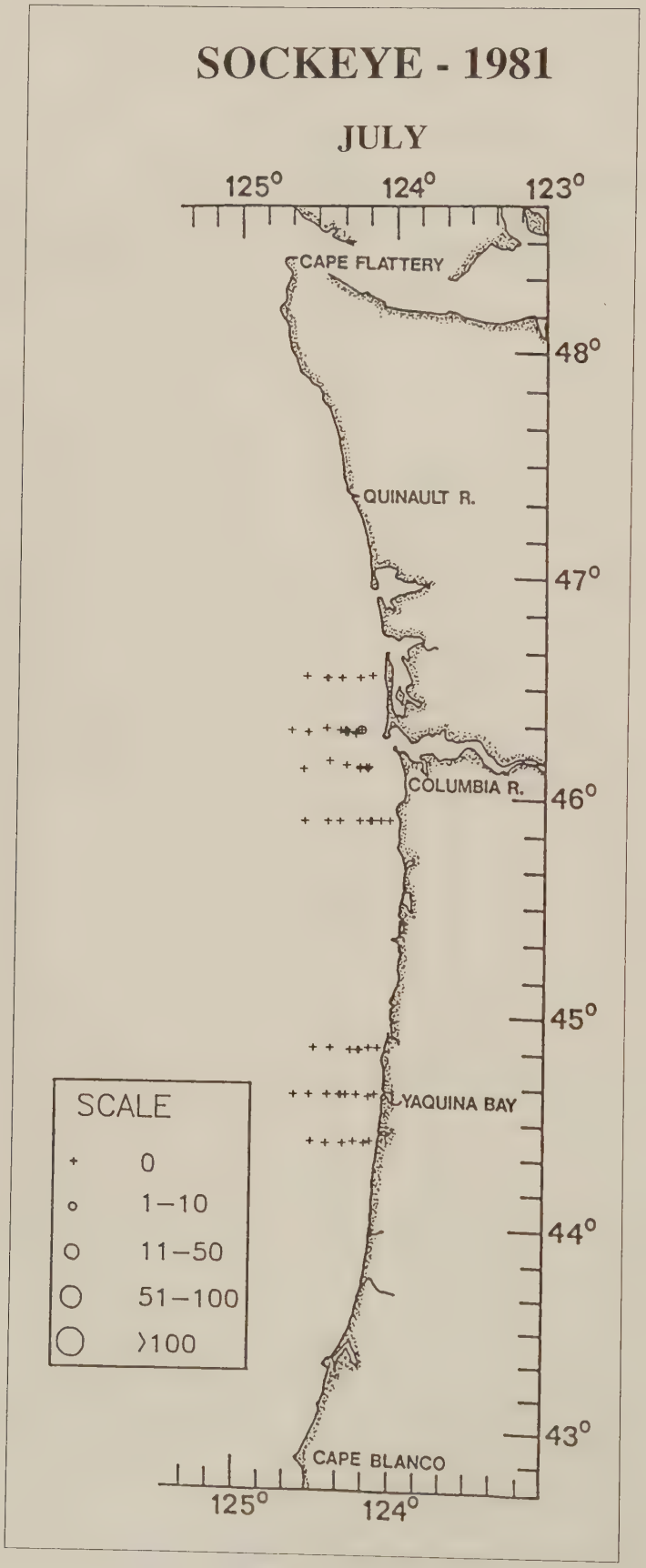
SOCKEYE - 1981
JULY
125°
124°
123°
CAPE FLATTERY
48°
QUINAULT R.
47°
COLUMBIA R.
46°
45°
YAQUINA BAY
44°
43°
CAPE BLANCO
125°
124°
SCALE
0
1–10
11–50
51–100
>100

Figure 8B

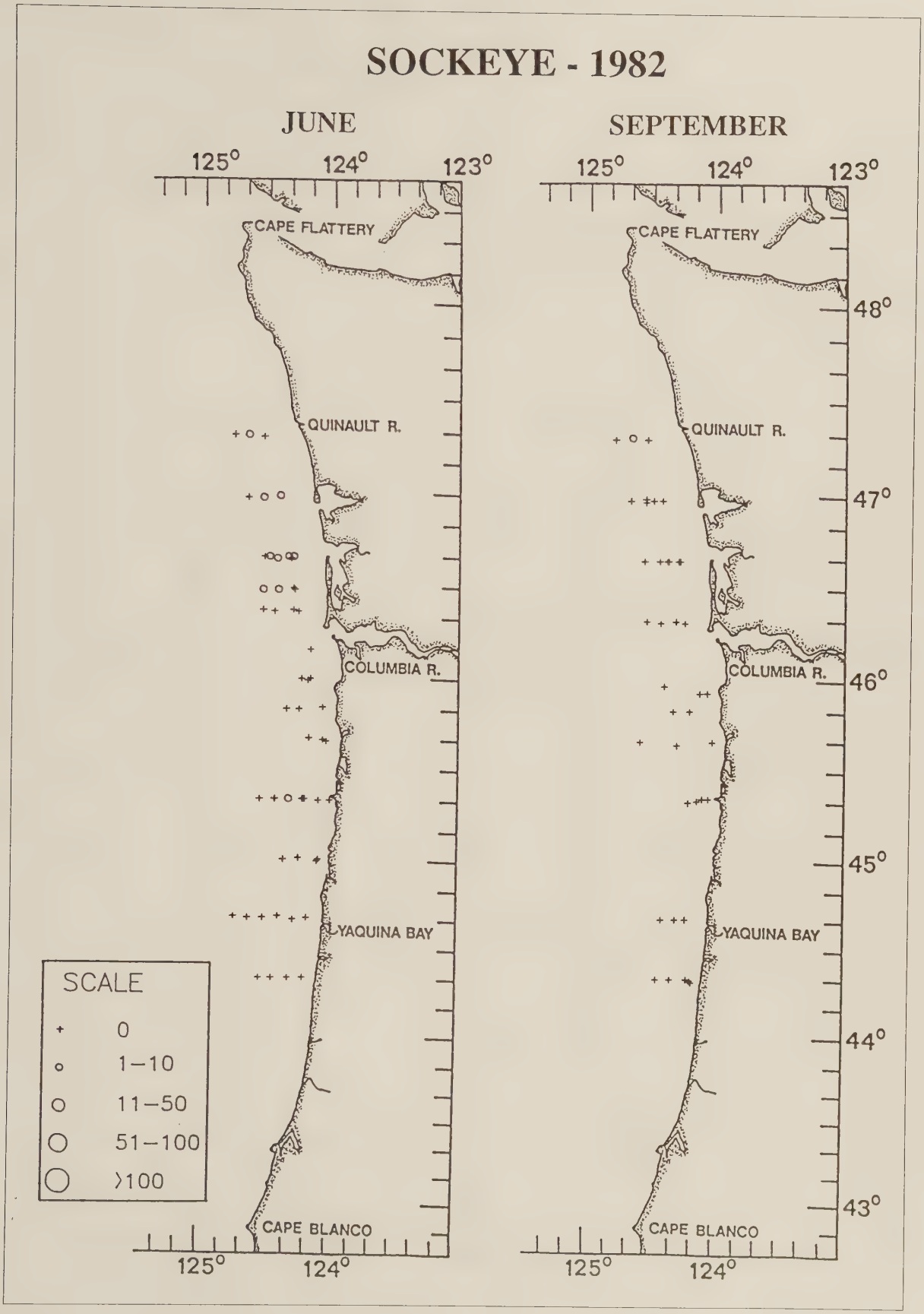
SOCKEYE - 1982
JUNE
SEPTEMBER
125°
124°
123°
CAPE FLATTERY
QUINAULT R.
COLUMBIA R.
YAQUINA BAY
CAPE BLANCO
48°
47°
46°
45°
44°
43°
SCALE
0
1–10
11–50
51–100
>100

Figure 8C

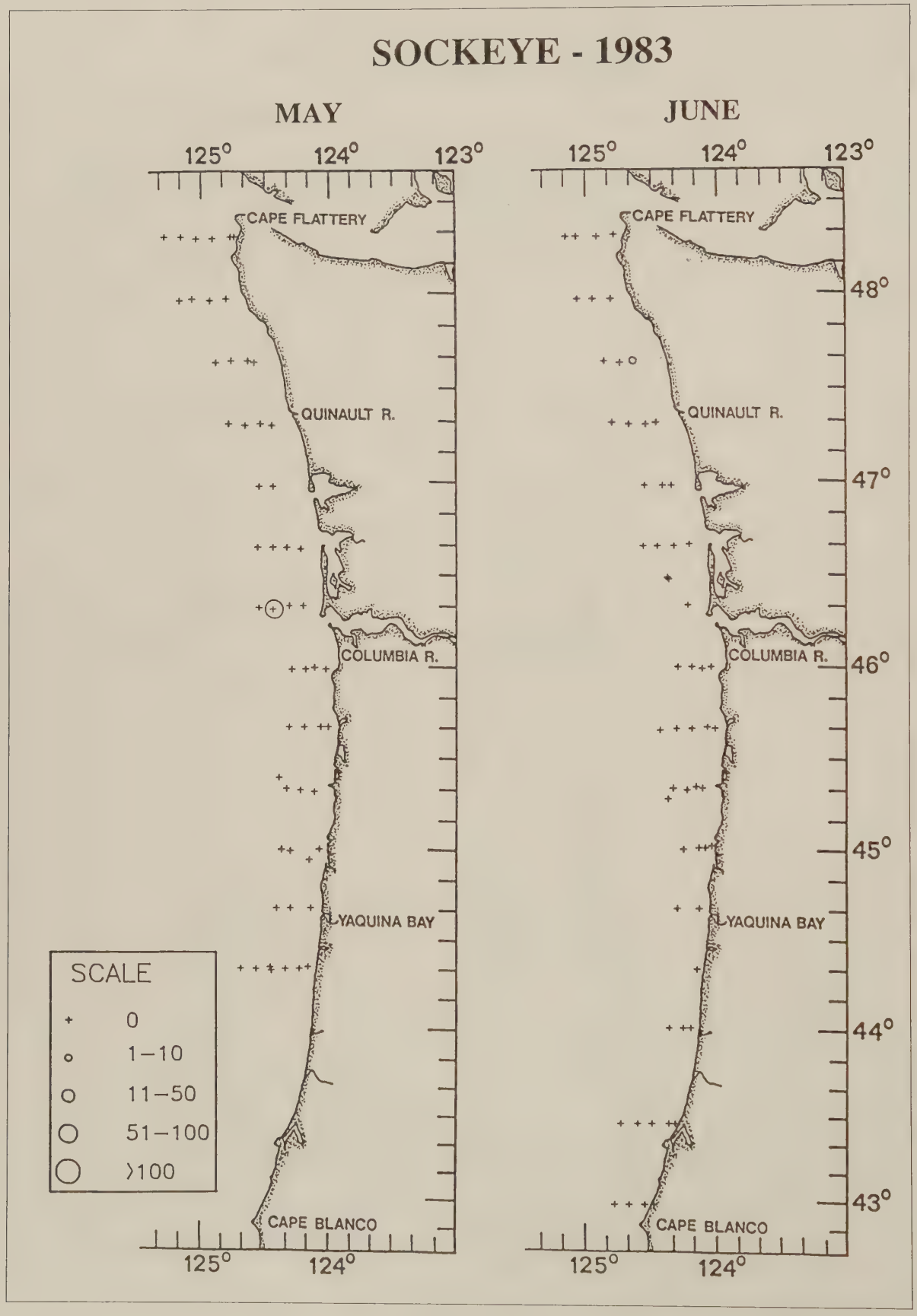
SOCKEYE - 1983
MAY
JUNE
125°
124°
123°
CAPE FLATTERY
QUINAULT R.
COLUMBIA R.
YAQUINA BAY
CAPE BLANCO
48°
47°
46°
45°
44°
43°
SCALE
0
1–10
11–50
51–100
>100

Figure 8D

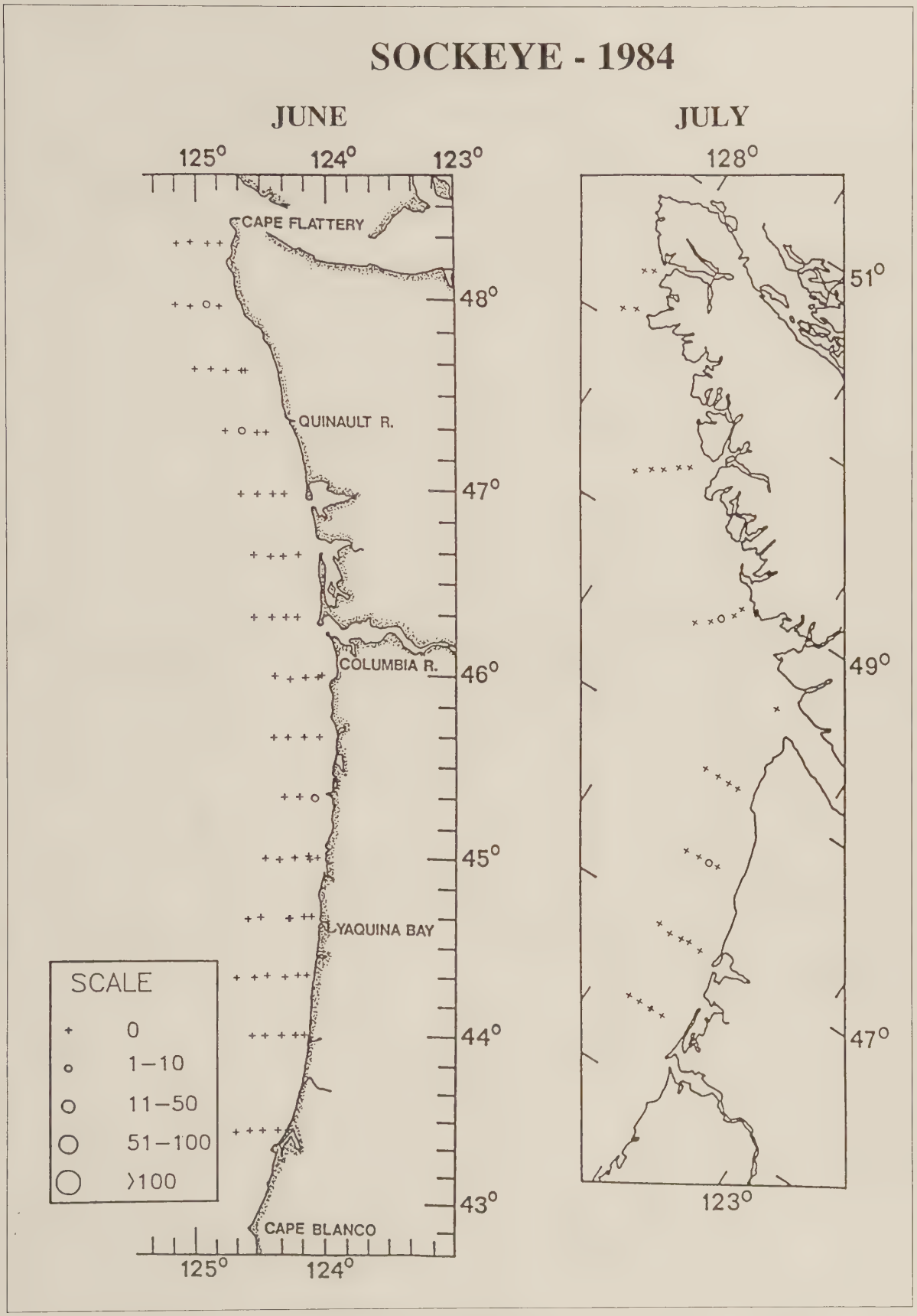
SOCKEYE - 1984
JUNE
JULY
125°
124°
123°
128°
CAPE FLATTERY
QUINAULT R.
COLUMBIA R.
YAQUINA BAY
CAPE BLANCO
48°
47°
46°
45°
44°
43°
51°
49°
47°
123°
SCALE
0
1–10
11–50
51–100
>100

Figure 8E

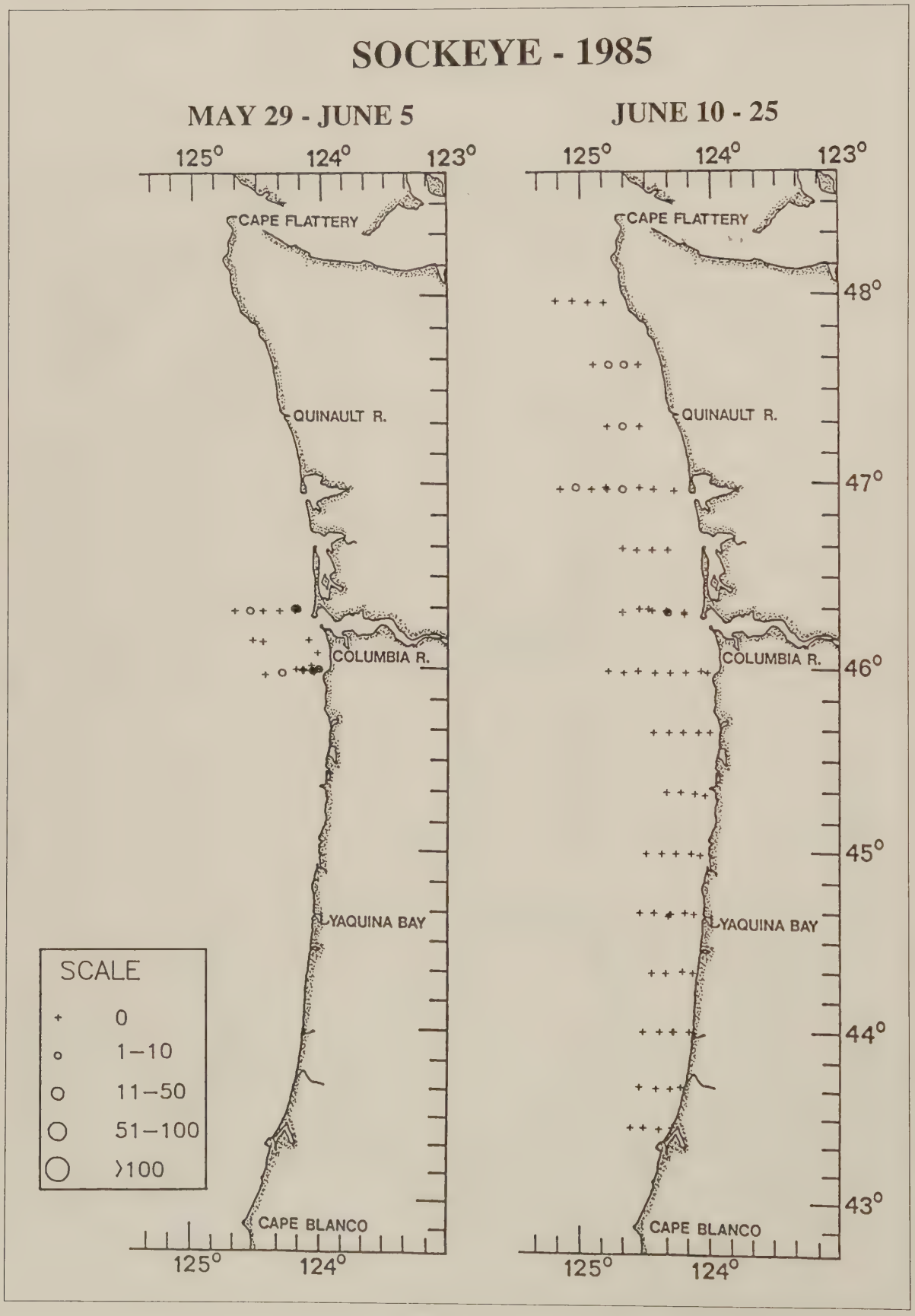
SOCKEYE - 1985
MAY 29 - JUNE 5
JUNE 10 - 25
125°
124°
123°
CAPE FLATTERY
QUINAULT R.
COLUMBIA R.
YAQUINA BAY
CAPE BLANCO
48°
47°
46°
45°
44°
43°
SCALE
0
1–10
11–50
51–100
>100

Figure 8F

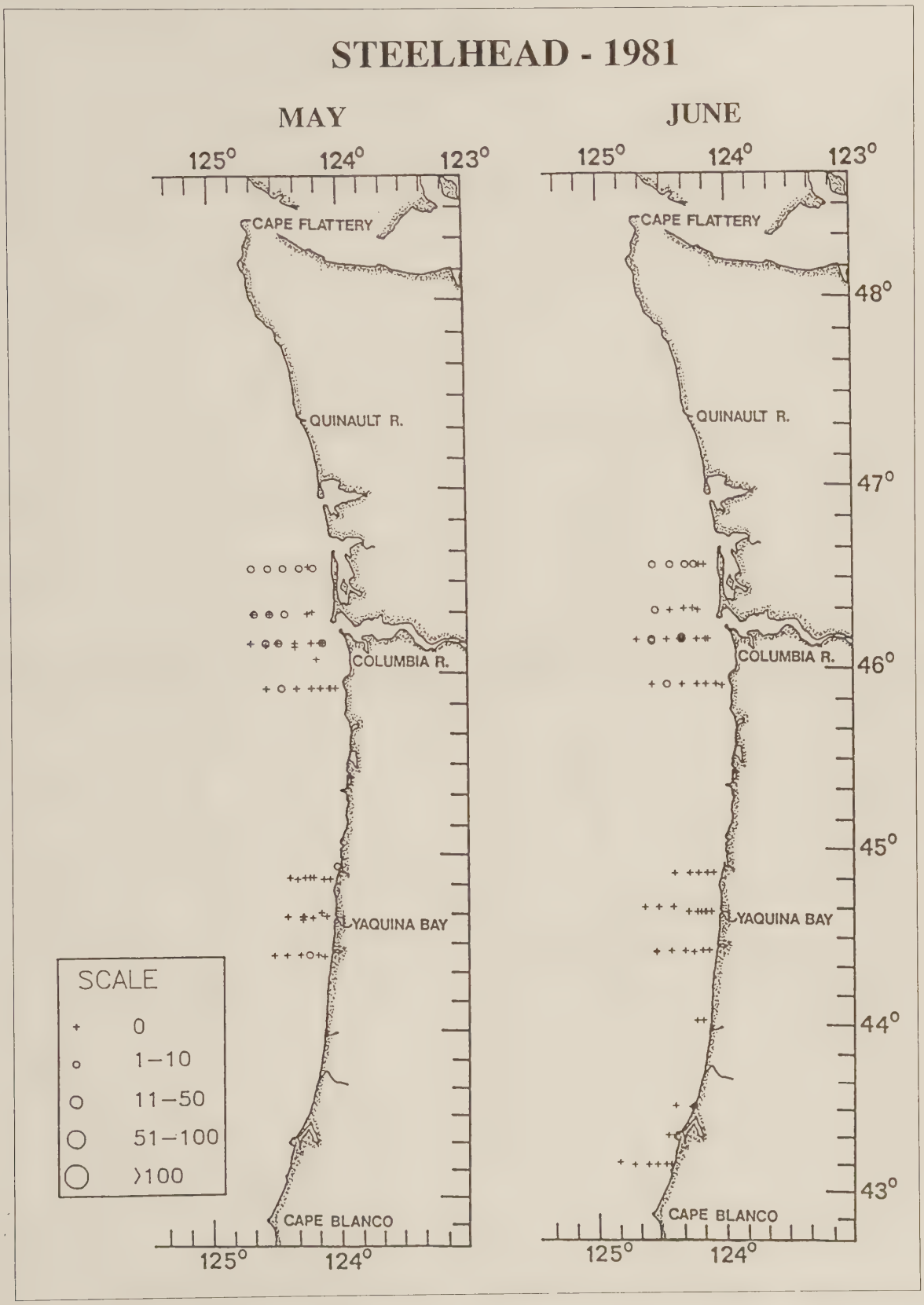

Figure 9A

Catch distribution of juvenile steelhead off Oregon and Washington for each cruise. Sampling was extended to British Columbia and California in 1984.

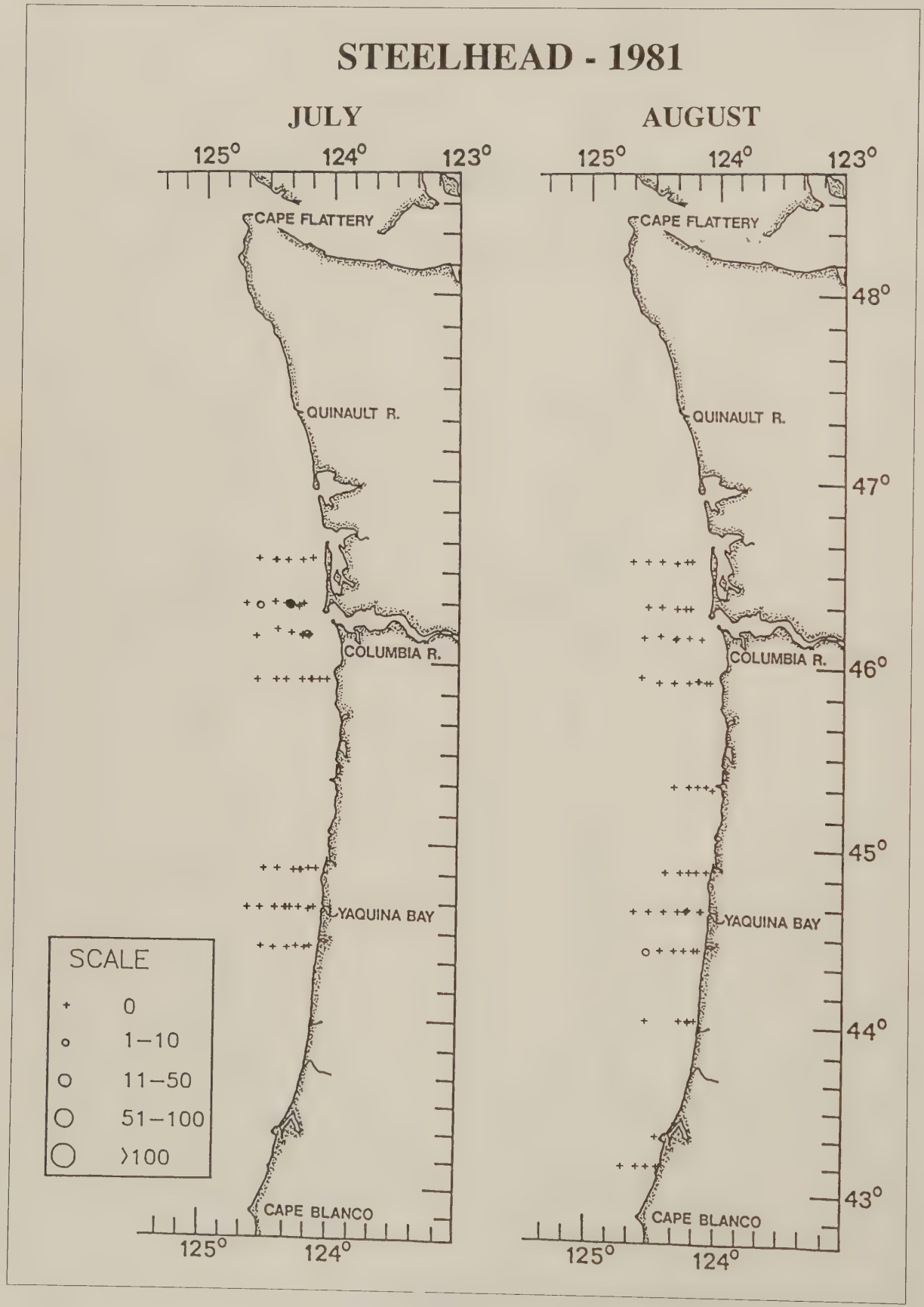
STEELHEAD - 1981
JULY
AUGUST
125°
124°
123°
48°
47°
46°
45°
44°
43°
CAPE FLATTERY
QUINAULT R.
COLUMBIA R.
YAQUINA BAY
CAPE BLANCO
SCALE
0
1–10
11–50
51–100
>100

Figure 9B

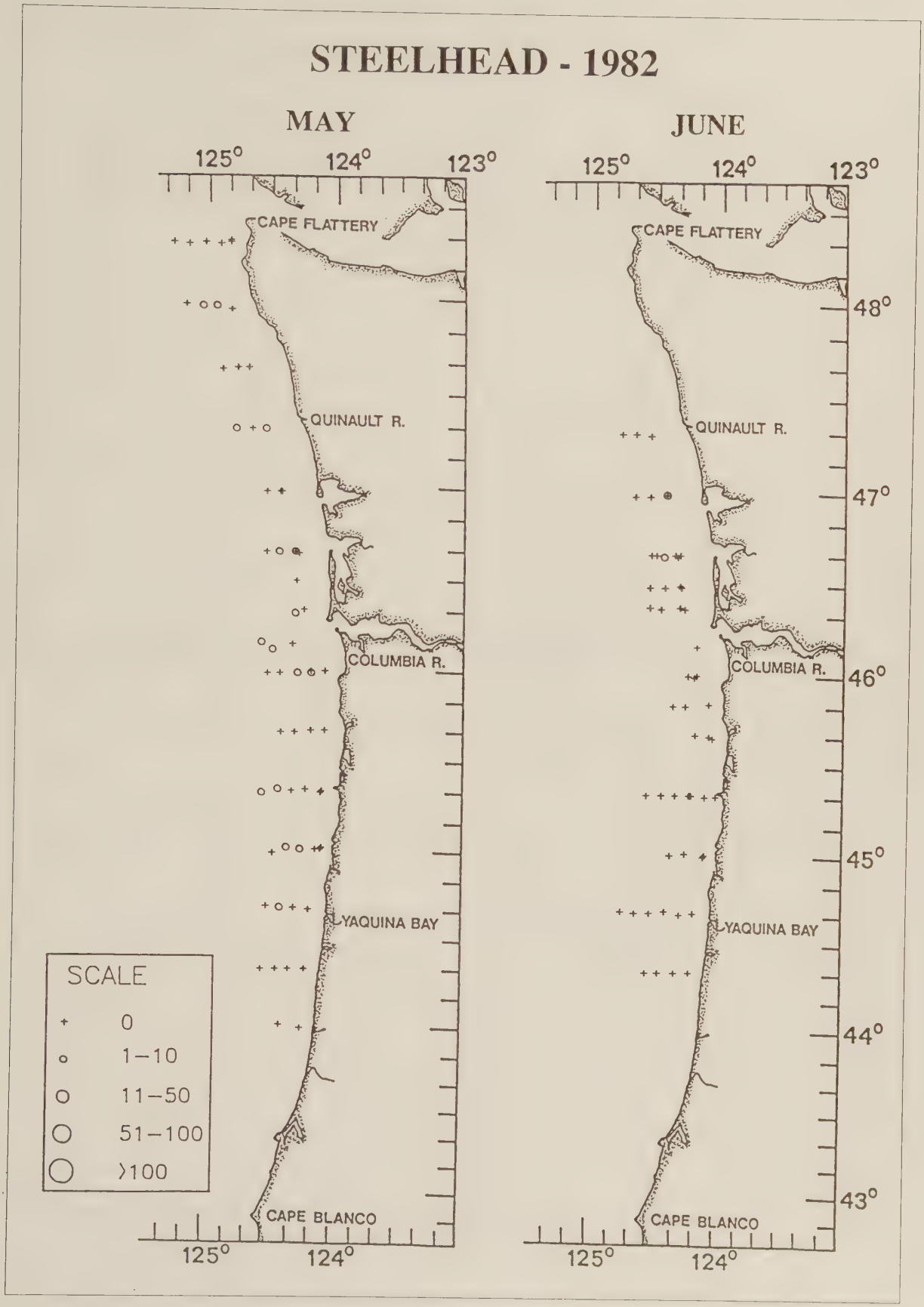
STEELHEAD - 1982
MAY
JUNE
125°
124°
123°
48°
47°
46°
45°
44°
43°
CAPE FLATTERY
QUINAULT R.
COLUMBIA R.
YAQUINA BAY
CAPE BLANCO
SCALE
0
1–10
11–50
51–100
>100

Figure 9C

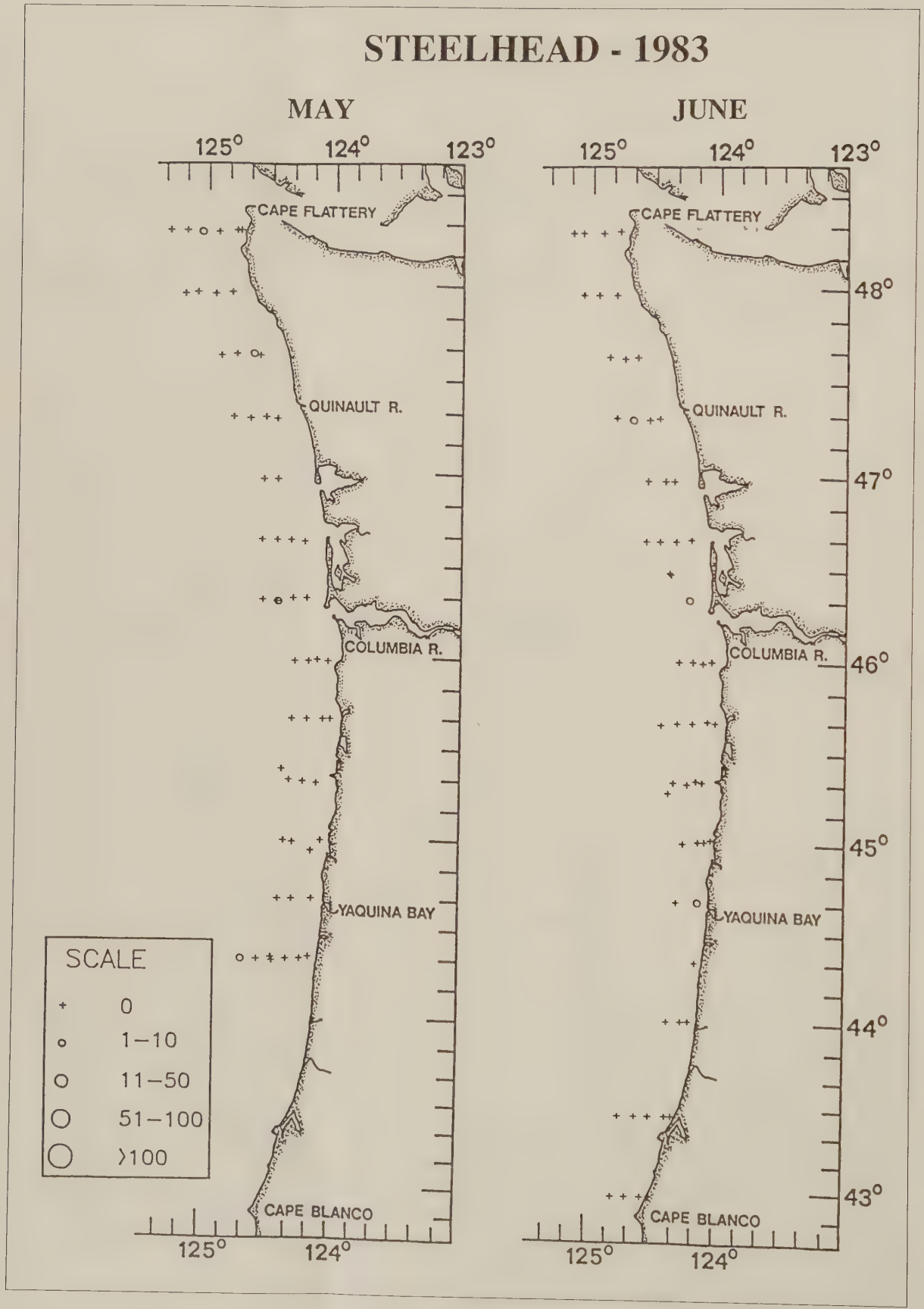
STEELHEAD - 1983
MAY
JUNE
125°
124°
123°
CAPE FLATTERY
QUINAULT R.
COLUMBIA R.
YAQUINA BAY
CAPE BLANCO
48°
47°
46°
45°
44°
43°
SCALE
0
1–10
11–50
51–100
>100

Figure 9D

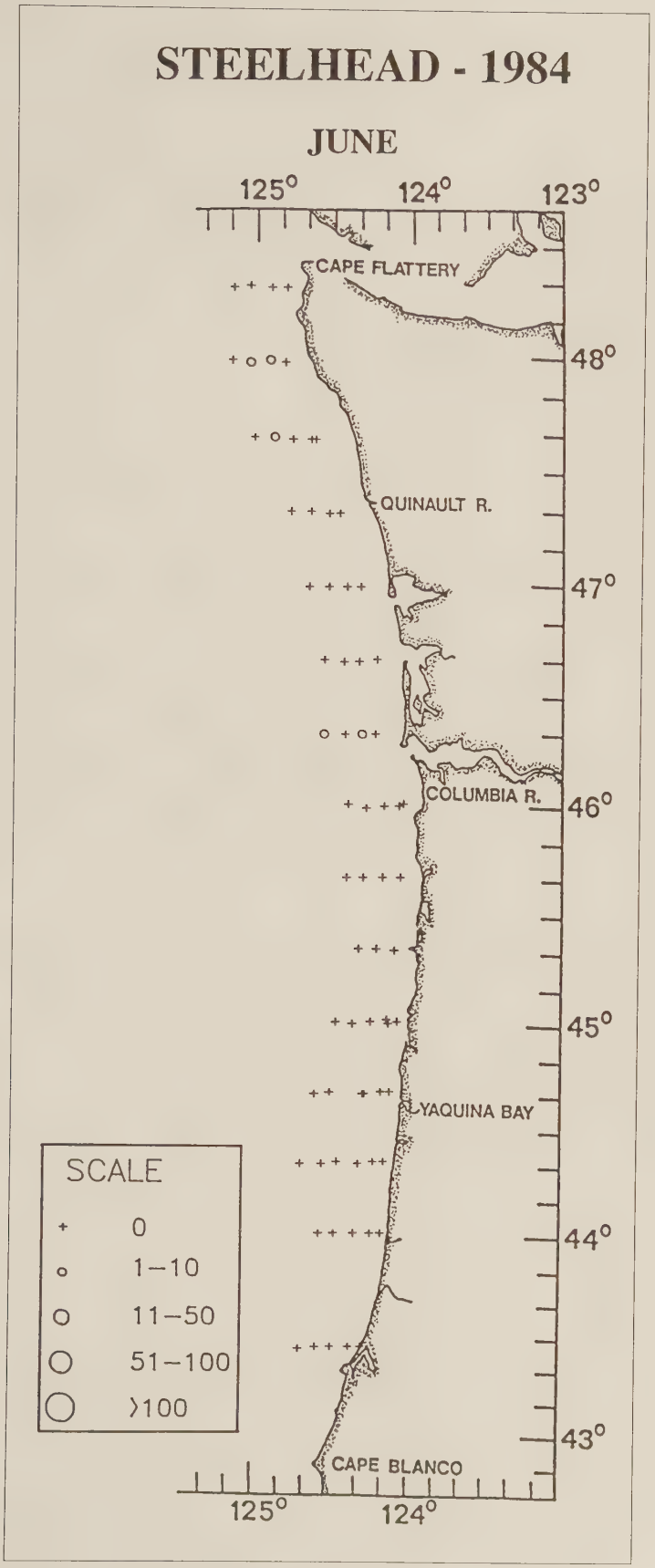
STEELHEAD - 1984
JUNE
125°
124°
123°
CAPE FLATTERY
48°
QUINAULT R.
47°
COLUMBIA R.
46°
45°
YAQUINA BAY
44°
43°
CAPE BLANCO
125°
124°
SCALE
0
1–10
11–50
51–100
>100

Figure 9E

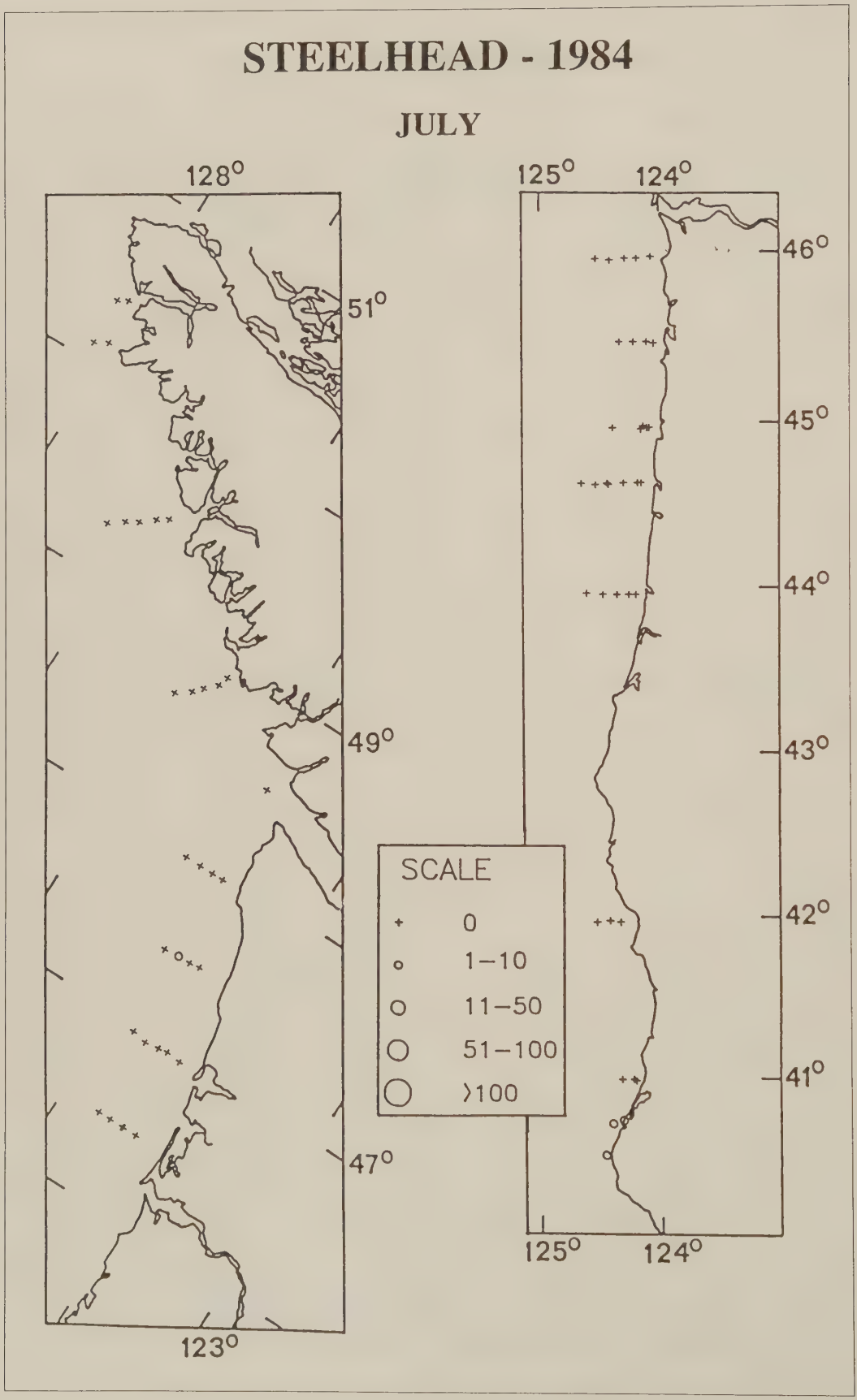
STEELHEAD - 1984
JULY
128°
125°
124°
51°
49°
47°
46°
45°
44°
43°
42°
41°
123°
SCALE
0
1–10
11–50
51–100
>100

Figure 9F

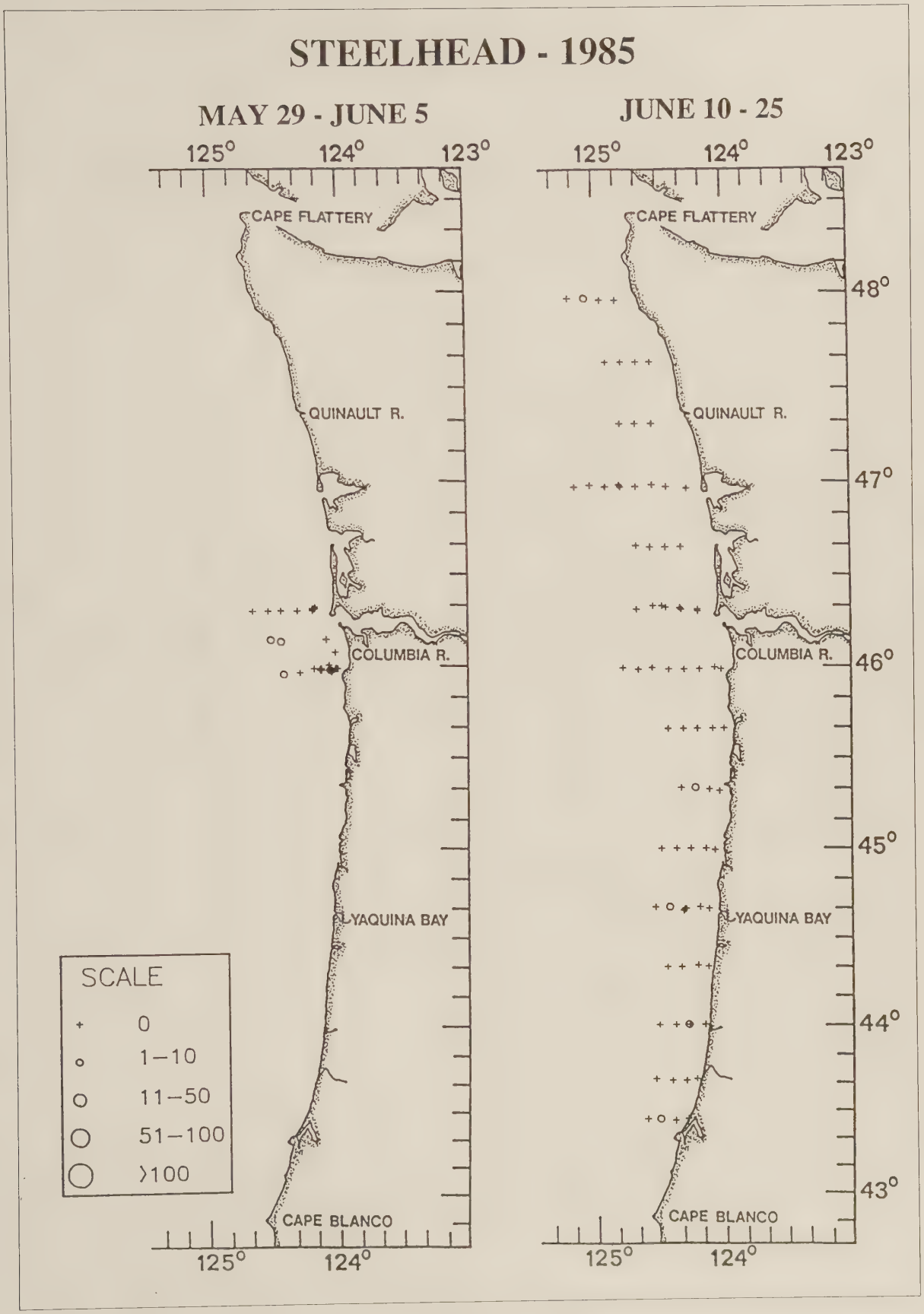
STEELHEAD - 1985
MAY 29 - JUNE 5
JUNE 10 - 25
125°
124°
123°
CAPE FLATTERY
QUINAULT R.
COLUMBIA R.
YAQUINA BAY
CAPE BLANCO
48°
47°
46°
45°
44°
43°
SCALE
0
1–10
11–50
51–100
>100

Figure 9G

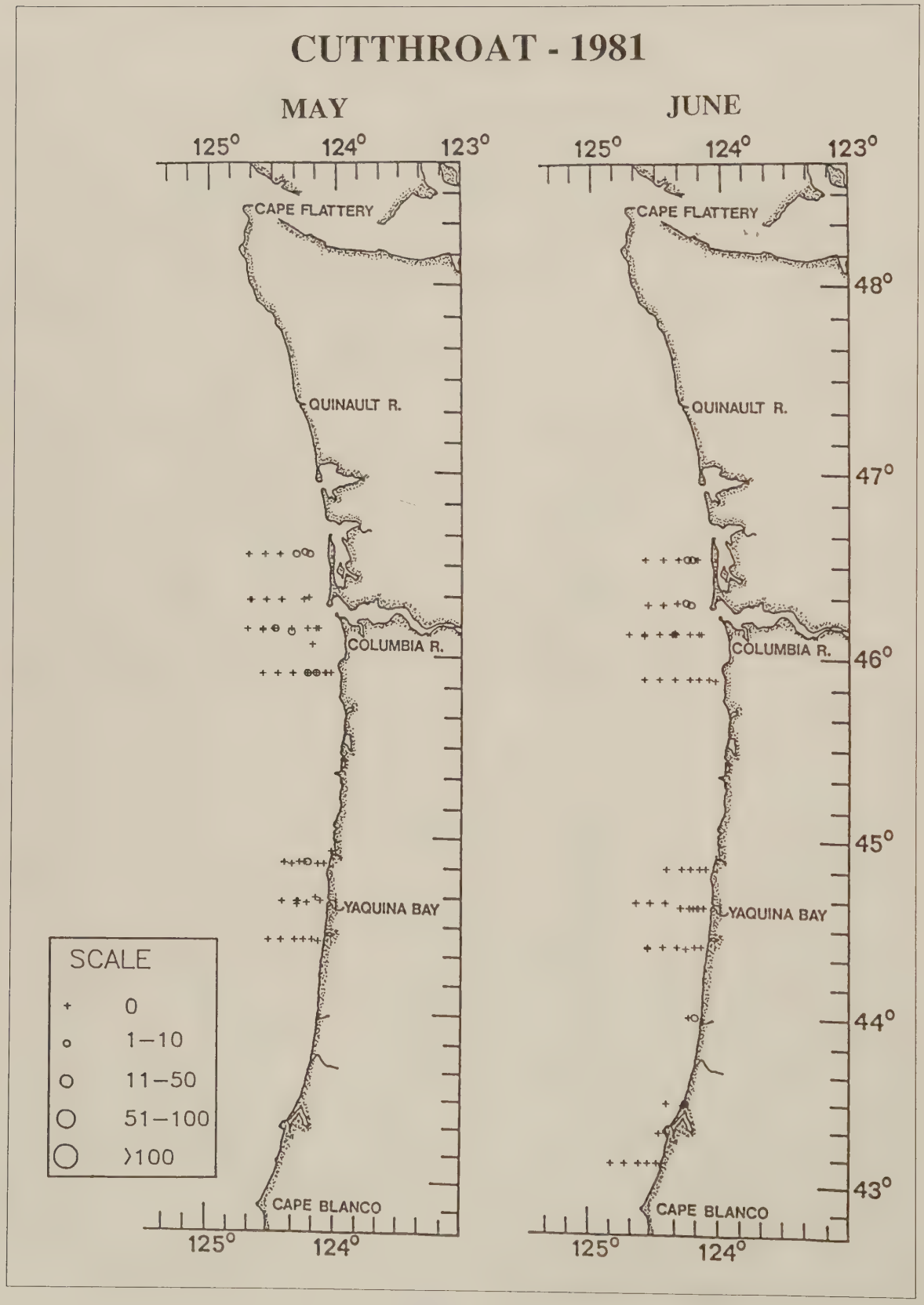

Figure 10A

Catch distribution of cutthroat trout off Oregon and Washington for each cruise. Sampling was extended to British Columbia and California in 1984.

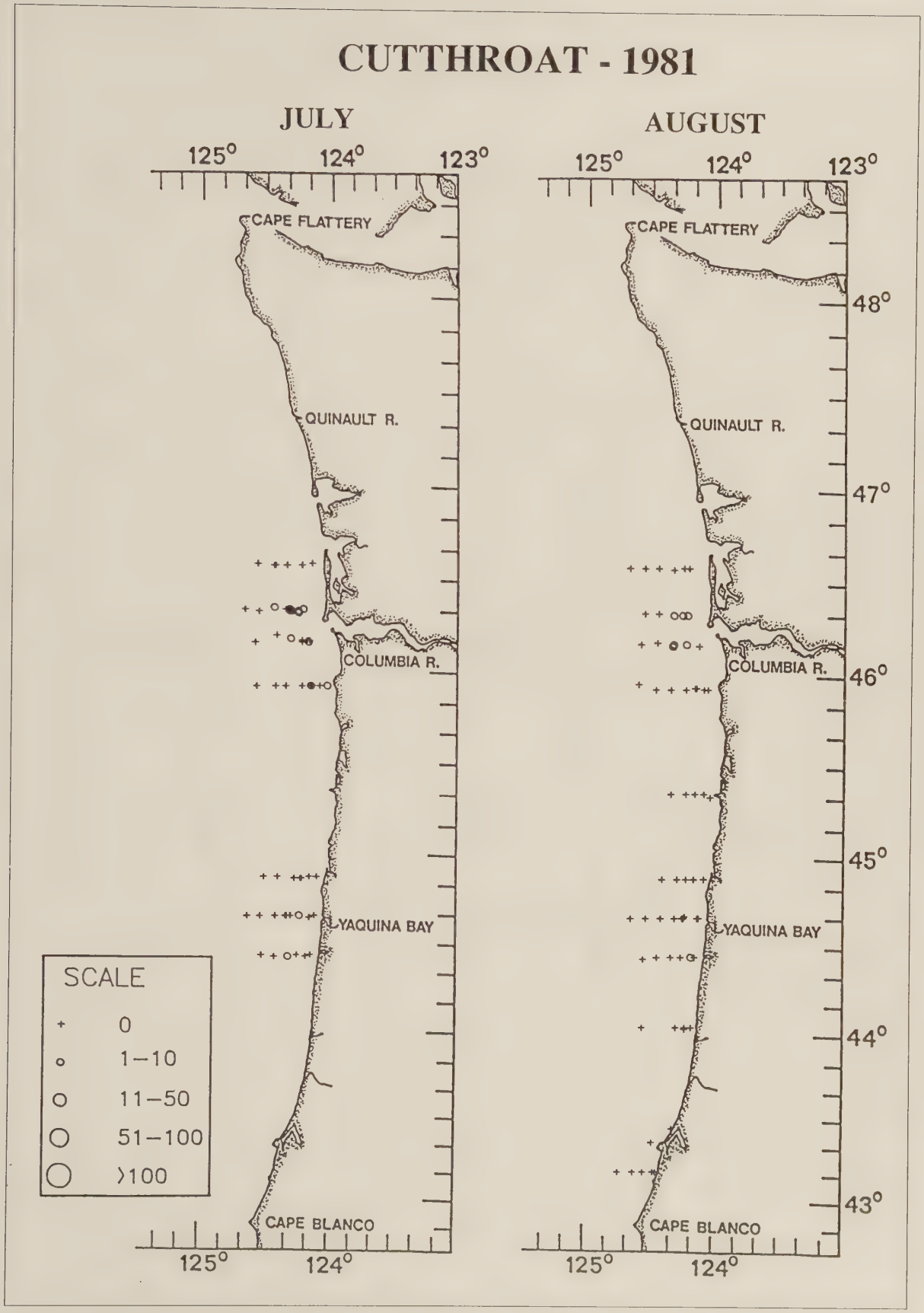
CUTTHROAT - 1981
JULY
AUGUST
125°
124°
123°
CAPE FLATTERY
QUINAULT R.
COLUMBIA R.
YAQUINA BAY
CAPE BLANCO
48°
47°
46°
45°
44°
43°
SCALE
0
1–10
11–50
51–100
>100

Figure 10B

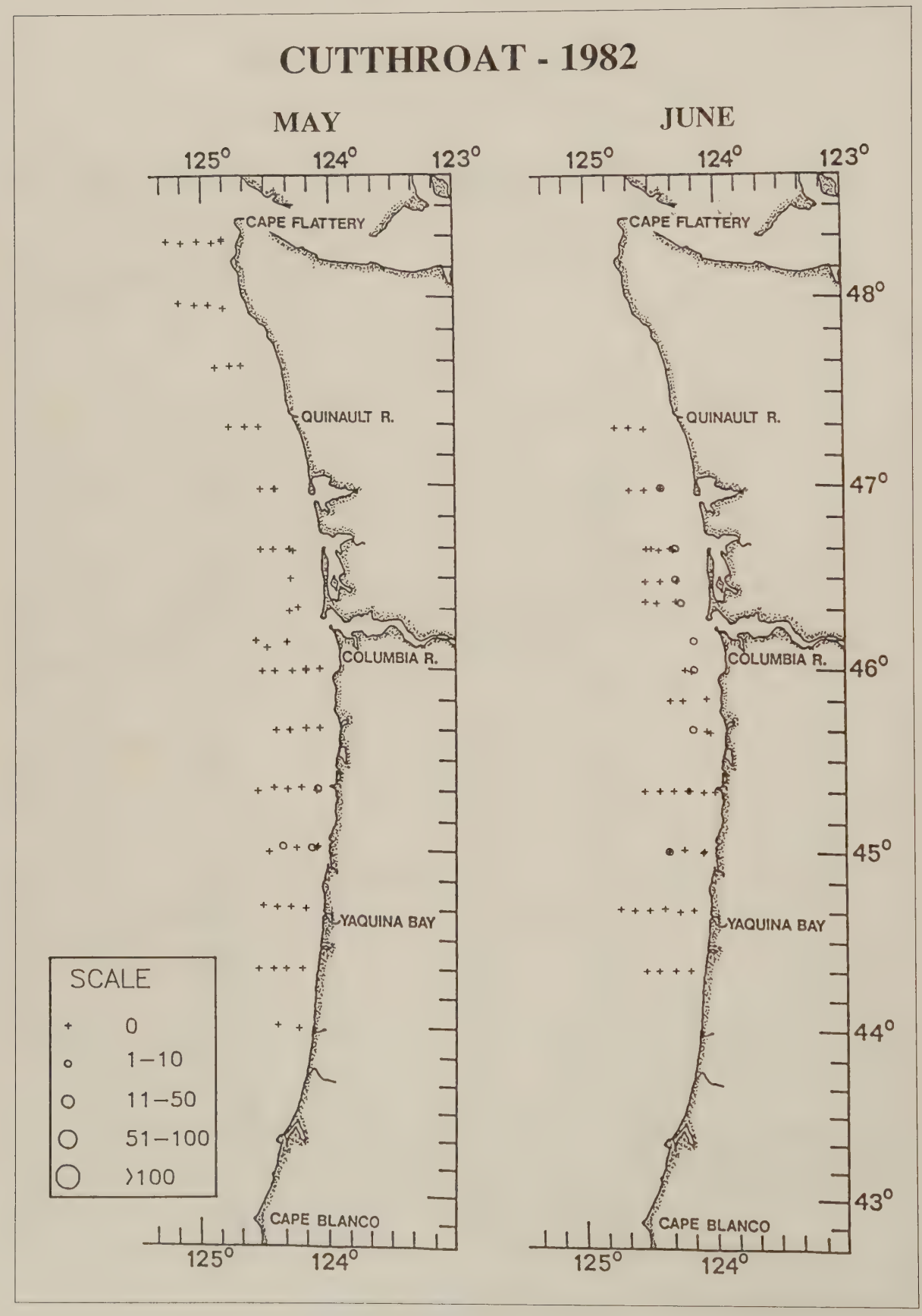
CUTTHROAT - 1982
MAY
JUNE
125°
124°
123°
CAPE FLATTERY
QUINAULT R.
COLUMBIA R.
YAQUINA BAY
CAPE BLANCO
48°
47°
46°
45°
44°
43°
SCALE
0
1–10
11–50
51–100
>100

Figure 10C

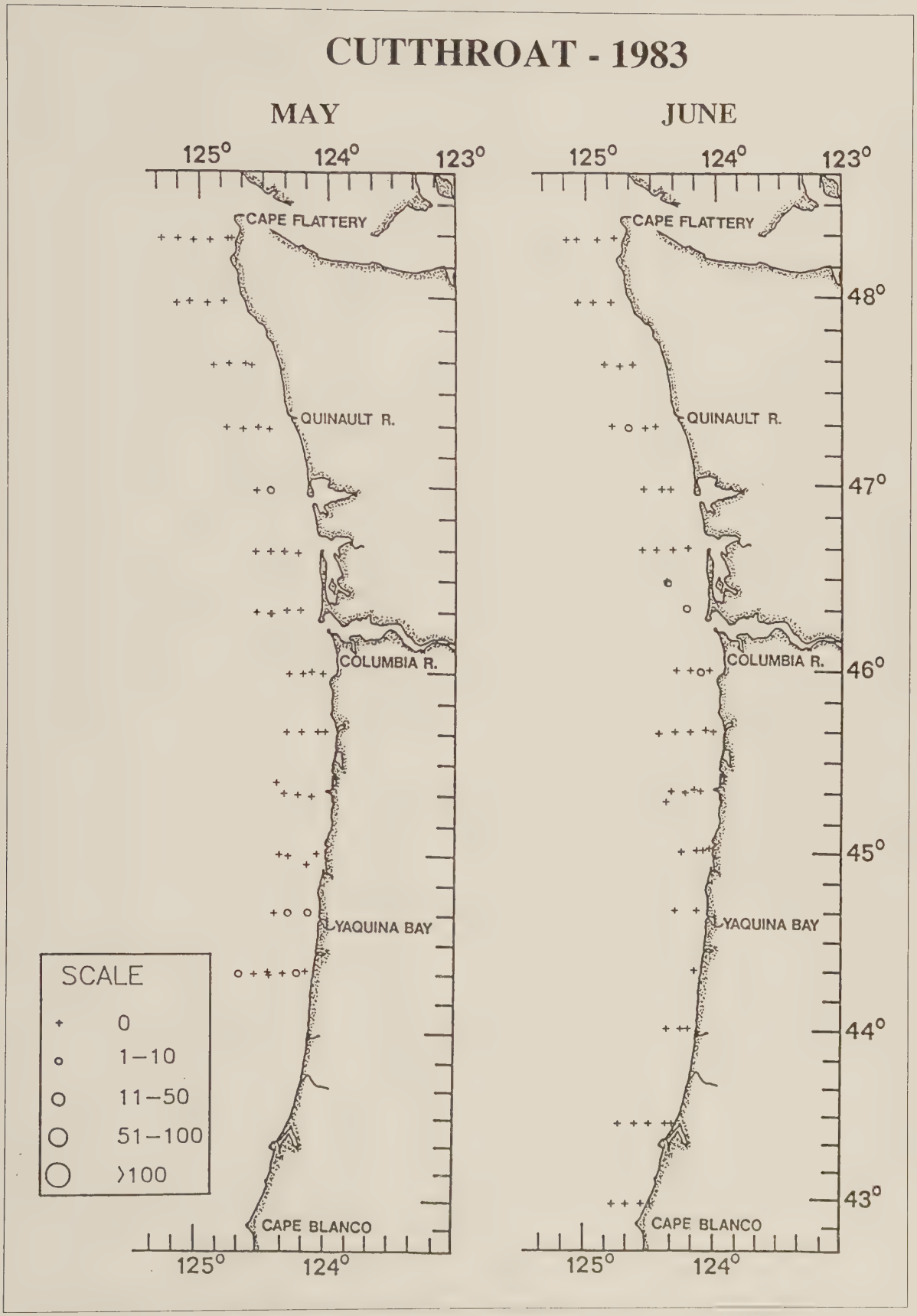
CUTTHROAT - 1983
MAY
JUNE
125°
124°
123°
CAPE FLATTERY
QUINAULT R.
COLUMBIA R.
YAQUINA BAY
CAPE BLANCO
48°
47°
46°
45°
44°
43°
SCALE
0
1–10
11–50
51–100
>100

Figure 10D

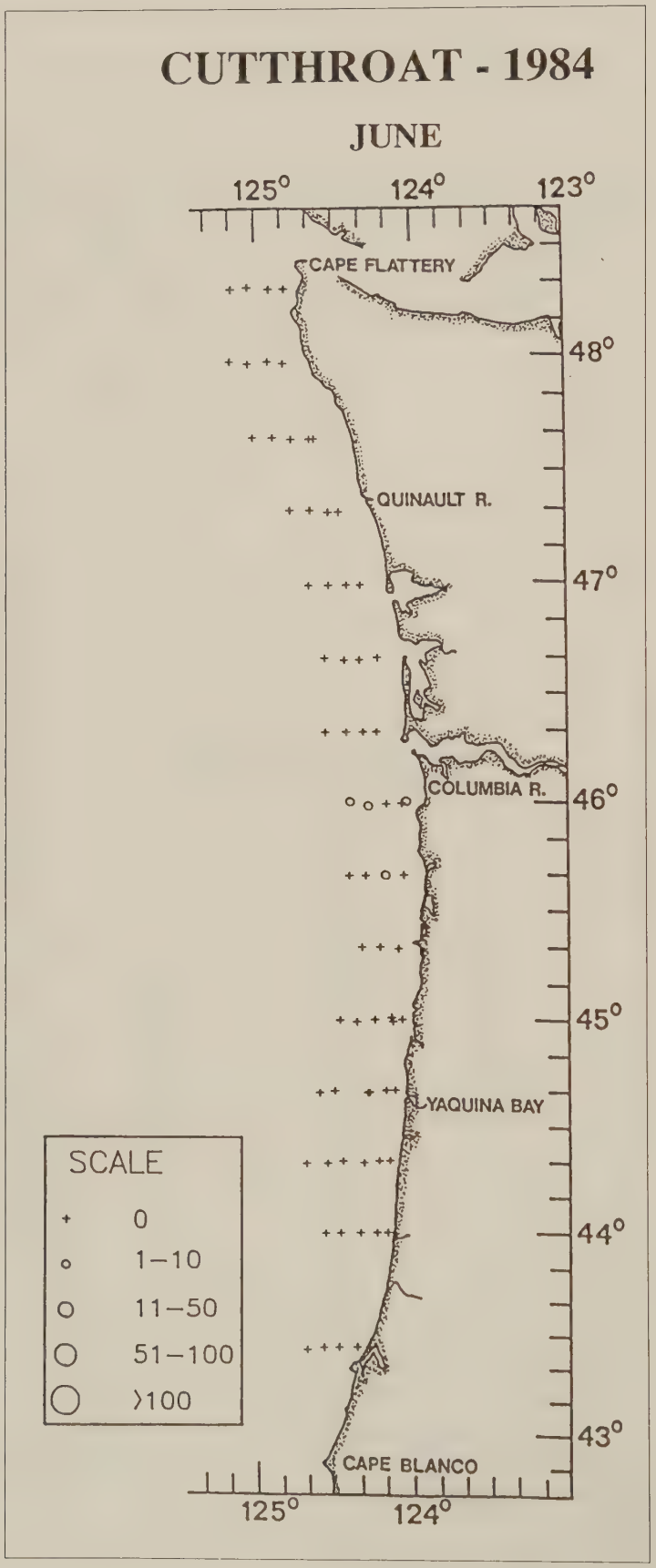
CUTTHROAT - 1984
JUNE
125°
124°
123°
CAPE FLATTERY
48°
QUINAULT R.
47°
COLUMBIA R.
46°
45°
YAQUINA BAY
44°
43°
CAPE BLANCO
125°
124°
SCALE
0
1–10
11–50
51–100
>100

Figure 10E

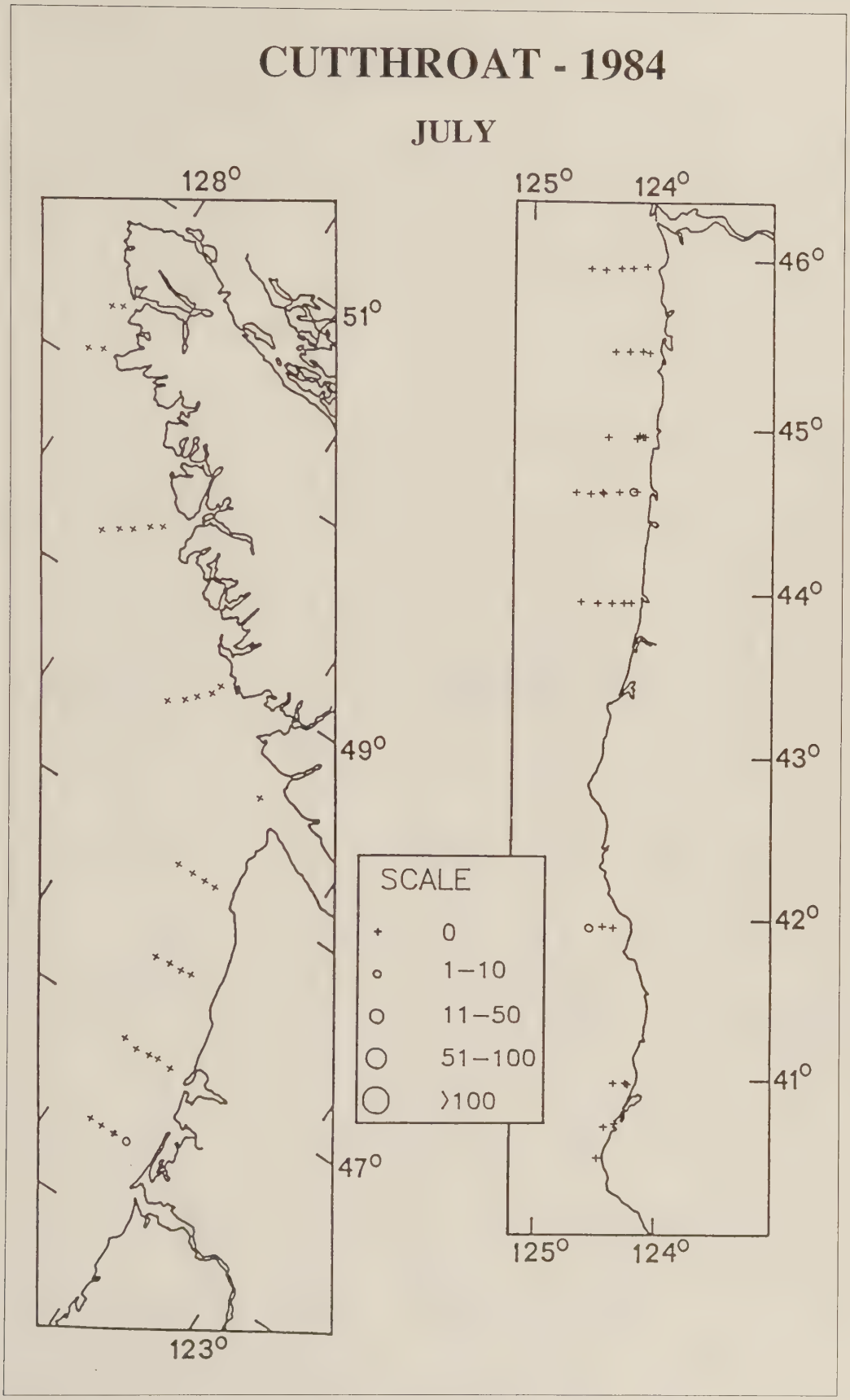
CUTTHROAT - 1984
JULY
128°
125°
124°
51°
49°
47°
46°
45°
44°
43°
42°
41°
123°
SCALE
0
1–10
11–50
51–100
>100

Figure 10F

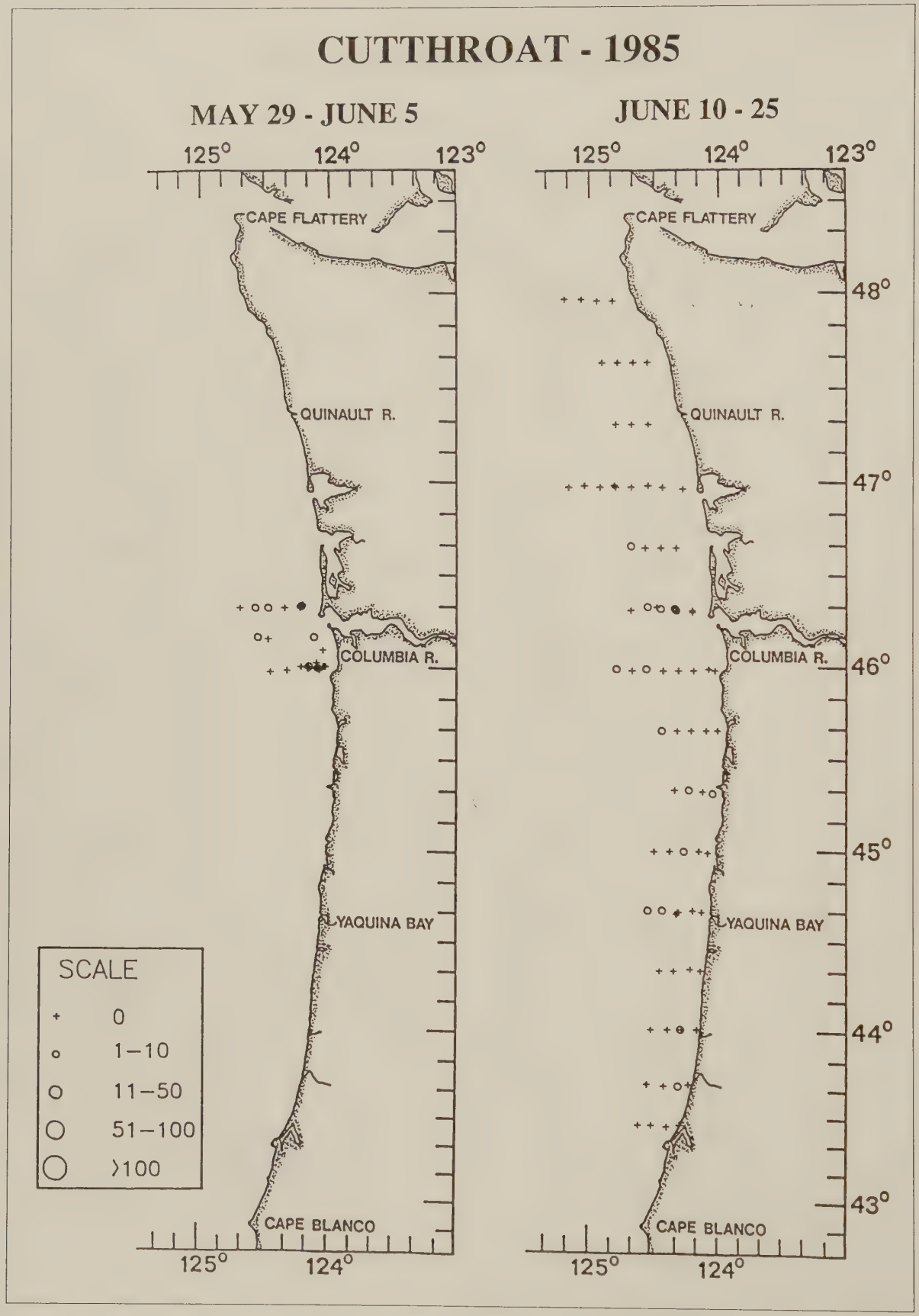
CUTTHROAT - 1985
MAY 29 - JUNE 5
JUNE 10 - 25
125°
124°
123°
CAPE FLATTERY
QUINAULT R.
COLUMBIA R.
YAQUINA BAY
CAPE BLANCO
48°
47°
46°
45°
44°
43°
SCALE
0
1–10
11–50
51–100
>100

Figure 10G

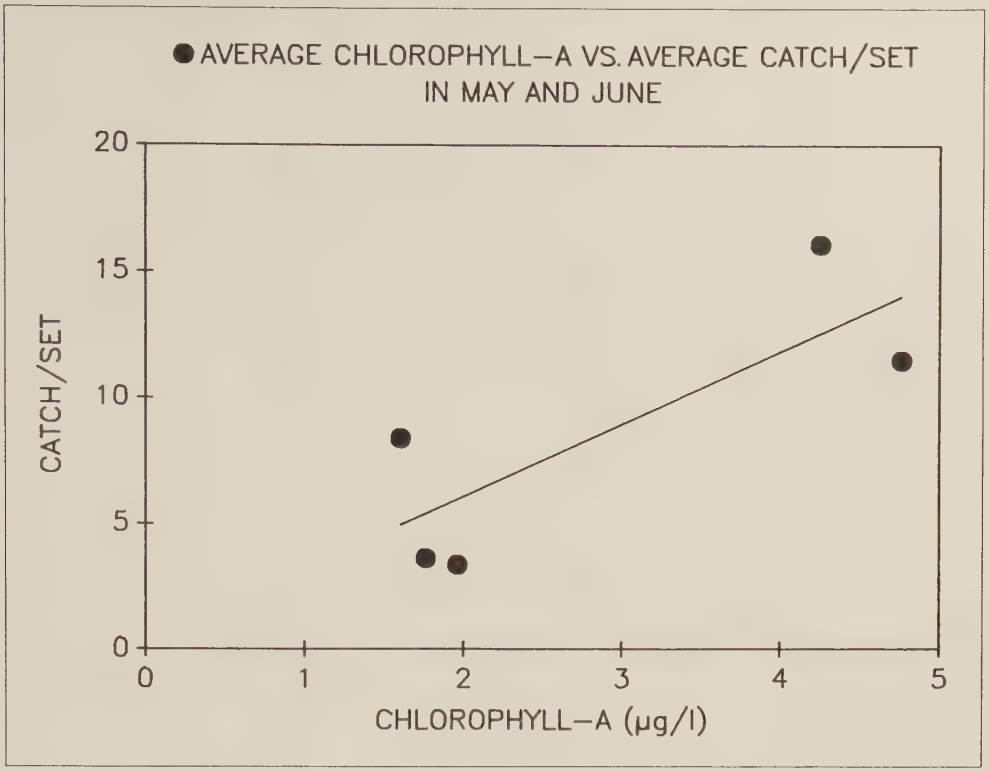

Figure 11
Average chlorophyll-*a* concentration at the surface during the May and June cruises combined vs. average catch/set of juvenile coho during those same cruises.

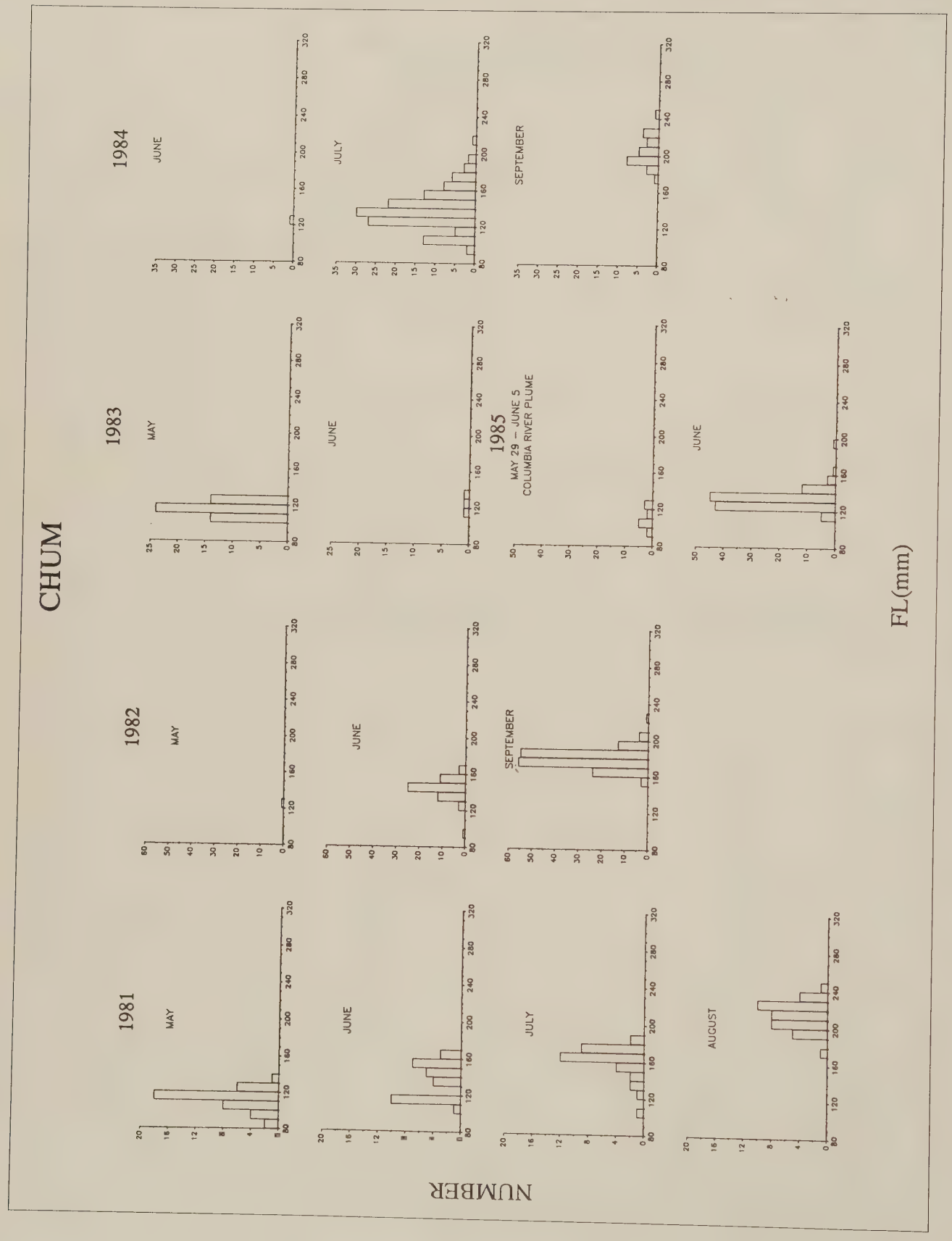

Figure 12

Length-frequency distributions of juvenile chum salmon in purse seine catches in different months and years, all transects combined.

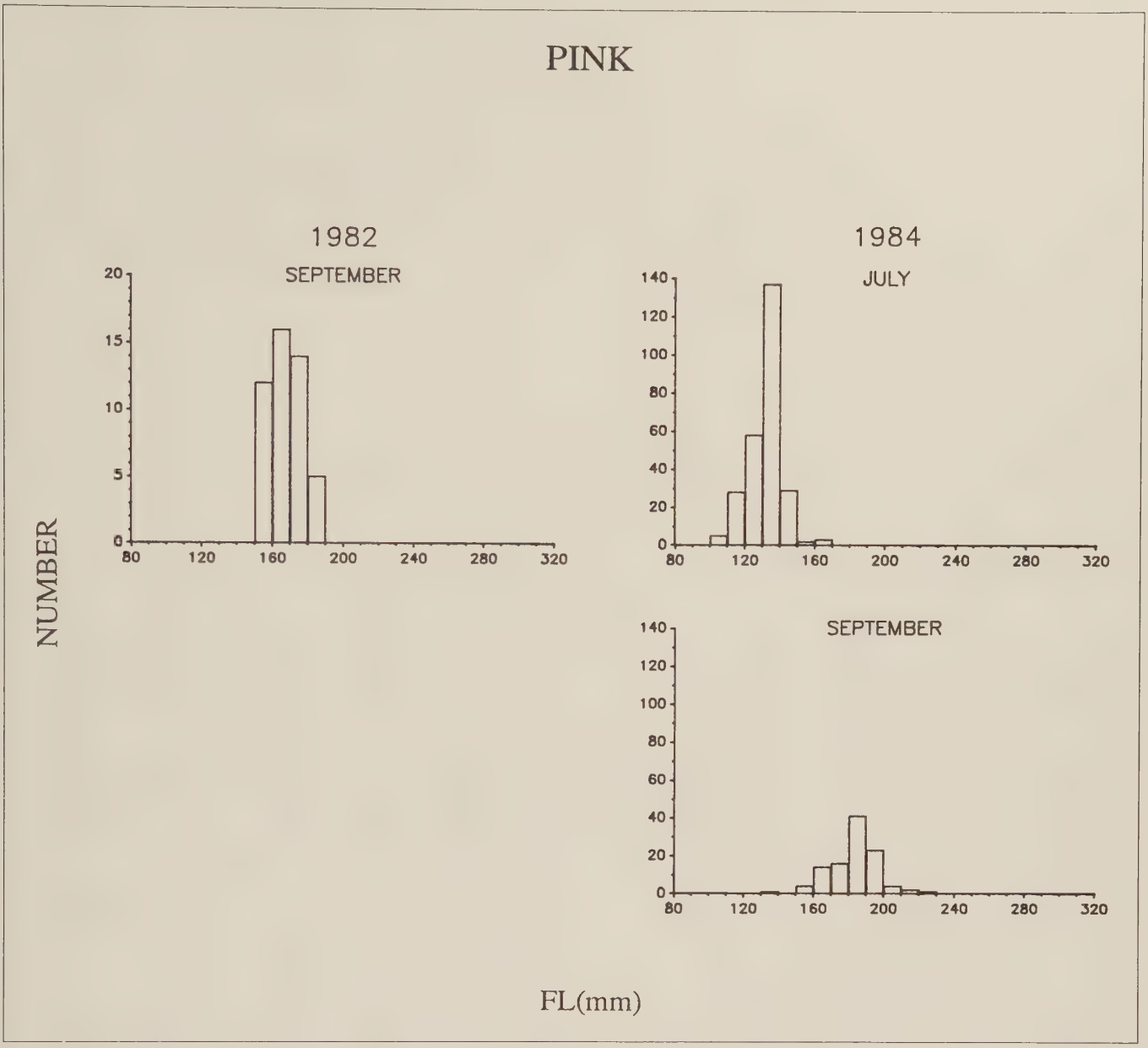

Figure 13
Length-frequency distributions of juvenile pink salmon during September 1982 and July and September 1984, when the largest catches occurred, all transects combined.

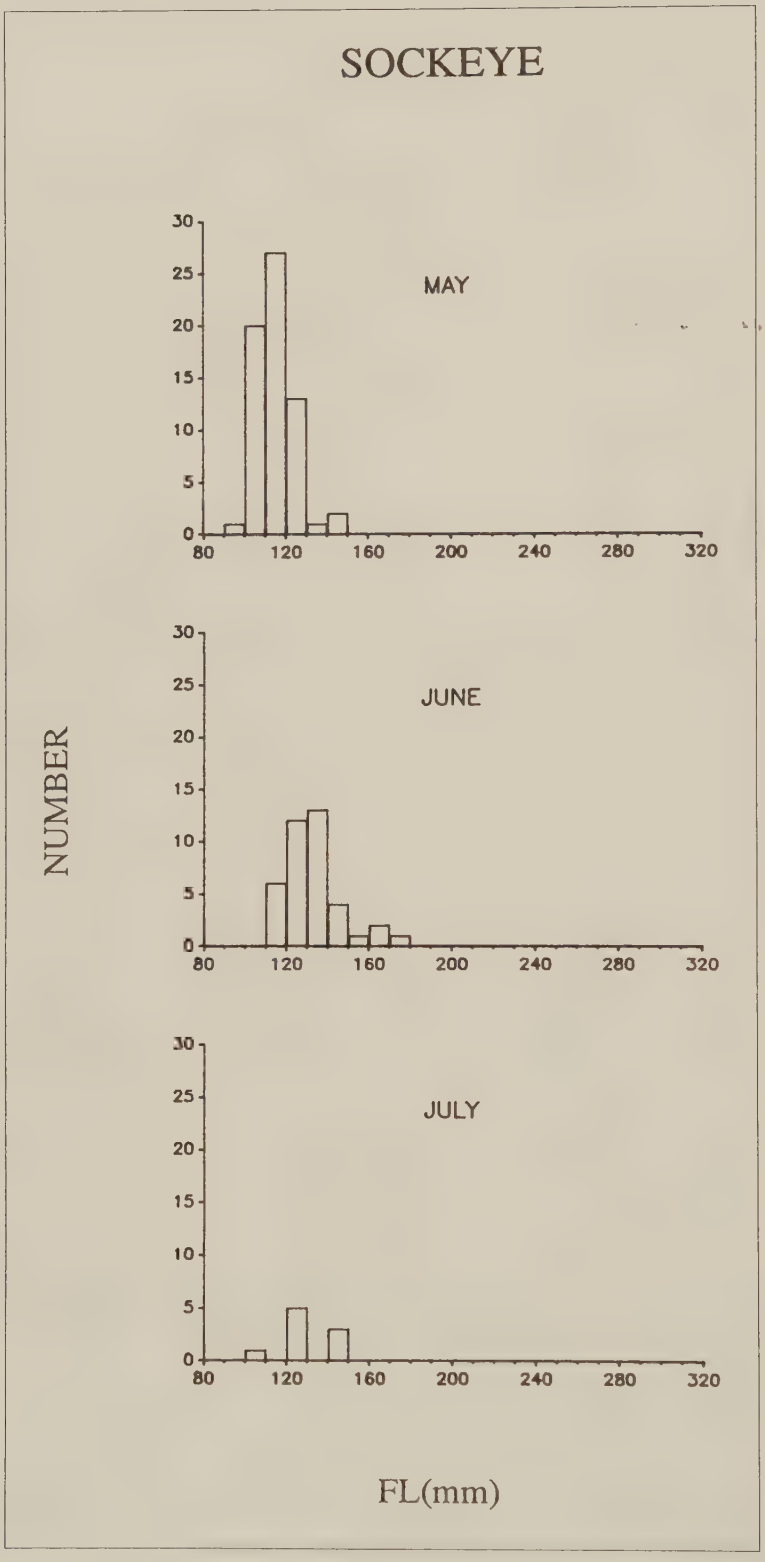

Figure 14
Length-frequency distributions of sockeye salmon in different months. Catches in all years and transects have been combined.

Appendix

Salmonids tagged with coded wire collected in purse seines, 1981–1985.

Abbreviations of tagging agencies stand for the following:

ANAD	Anadromous Inc.
CDFG	California Department of Fish and Game
CDFO	Canada Department of Fisheries and Oceans
COOP	Washington Department of Fisheries-Cooperative
DOMS	Domsea Farms, Inc.
FWS	U.S. Fish and Wildlife Service
HOH	Hoh Indian Tribe
IDFG	Idaho Department of Fish and Game
NMFS	National Marine Fisheries Service
OAF	Oregon Aqua Foods, Inc.
ODFW	Oregon Department of Fish and Wildlife
QDNR	Quinault Department of Natural Resources
SQAX	Squaxin Indian Tribe
TULA	Tulalip Indian Tribe
UI	University of Idaho-FWS Cooperative
UW	University of Washington
WDF	Washington Department of Fisheries
YAKI	Yakima Indian Tribe

Abbreviated with hatcheries:

M	Fish caught in Columbia River at this location and released downstream.
NFH	National Fish Hatchery

Release data					Recovery data				
Tag code	Species	Brood year	Agency	Hatchery	Set	Latitude	Longitude	Date	Length (mm)
				1981					
031733	chinook	80	NMFS	McNary (M)	228	46 09.5	124 06.4	08/12/81	137
066109	chinook	79	CDFG	Trinity R.	16	44 25.0	124 19.0	05/18/81	290
072220	chinook	79	ODFW	McKenzie	57	46 35.0	124 11.1	05/23/81	277
072222	chinook	79	ODFW	McKenzie	151	46 10.2	124 08.8	07/11/81	206
072229	chinook	79	ODFW	Rock Creek	122	43 11.4	124 29.6	06/16/81	295
072253	chinook	79	ODFW	Marion Forks	65	46 09.0	124 20.1	05/22/81	185
072254	chinook	79	ODFW	Marion Forks	183	45 55.0	124 20.2	07/14/81	214
102236	chinook	79	IDFG	Rapid R.	26	44 51.5	124 14.6	05/19/81	145
632251	chinook	80	WDF	Washougal	164	46 19.9	124 14.4	07/12/81	91
050638	coho	78	FWS	Willard	7	44 38.1	124 17.7	05/16/81	514
050739	coho	79	HOH	Chalaat Cr.	30	45 55.1	124 12.5	05/20/81	143
050826	coho	79	FWS	Eagle Cr. NFH	30	45 55.1	124 12.5	05/20/81	153
050826	coho	79	FWS	Eagle Cr. NFH	90	46 10.0	124 20.8	06/11/81	173
050827	coho	79	FWS	Eagle Cr. NFH	30	45 55.1	124 12.5	05/20/81	150
050828	coho	79	FWS	Eagle Cr. NFH	30	45 55.1	124 12.5	05/20/81	154
050828	coho	79	FWS	Eagle Cr. NFH	230	45 55.3	124 27.2	08/13/81	286
050828	coho	79	FWS	Eagle Cr. NFH	35	46 10.0	124 28.0	05/21/81	144
072033	coho	78	ODFW	Sandy	56	46 35.1	124 13.5	05/23/81	455
072113	coho	79	ODFW	Big Creek	6	44 38.1	124 17.6	05/16/81	146
072117	coho	79	ODFW	Big Creek	17	44 25.1	124 26.0	05/18/81	142
072118	coho	79	ODFW	Big Creek	47	46 20.0	124 25.4	05/22/81	154
072122	coho	79	ODFW	Big Creek	91	46 10.6	124 20.0	06/11/81	177
072123	coho	79	ODFW	Big Creek	190	44 38.6	124 19.6	07/17/81	186
072125	coho	79	ODFW	Big Creek	91	46 10.6	124 20.0	06/11/81	153
072130	coho	79	ODFW	Cascade Creek	83	46 09.9	124 20.3	06/11/81	183
072132	coho	79	ODFW	Cascade Creek	164	46 19.9	124 14.4	07/12/81	138
072132	coho	79	ODFW	Cascade Creek	198	44 51.2	124 16.3	07/18/81	156
072132	coho	79	ODFW	Cascade Creek	247	44 38.2	124 24.7	08/15/81	202
072238	coho	79	ODFW	Big Creek	234	45 55.7	124 07.9	08/13/81	188
072256	coho	79	ODFW	Sandy	30	45 55.1	124 12.5	05/20/81	146
72257	coho	79	ODFW	Sandy	77	46 20.1	124 18.3	06/10/81	190
072262	coho	79	ODFW	Sandy	30	45 55.1	124 12.5	05/20/81	140
072262	coho	79	ODFW	Sandy	30	45 55.1	124 12.5	05/20/81	136
072313	coho	79	ODFW	Butte Falls	91	46 10.6	124 20.0	06/11/81	200
072315	coho	79	ODFW	Nehalem	21	44 51.5	124 12.5	05/20/81	172
072316	coho	79	ODFW	Nehalem	25	44 50.8	124 20.2	05/19/81	151
072323	coho	79	ODFW	Siletz	10	44 38.3	124 17.8	05/18/81	150
072357	coho	80	ODFW	Cedar Cr.	226	46 10.1	124 18.3	08/12/81	163
600362	coho	80	OAF	Oregon Aqua-Foods	243	44 38.3	124 06.3	08/15/81	138
603153	coho	79	OAF	Oregon Aqua-Foods	7	44 38.1	124 17.7	05/16/81	437
603218	coho	80	OAF	Oregon Aqua-Foods	231	45 55.2	124 19.7	08/13/81	203
603343	coho	79	OAF	Oregon Aqua-Foods	83	46 09.9	124 20.3	06/11/81	495

Appendix (continued)

Release data					Recovery data				
Tag code	Species	Brood year	Agency	Hatchery	Set	Latitude	Longitude	Date	Length (mm)
				1981 (continued)					
603347	coho	79	OAF	Oregon Aqua-Foods	15	44 25.0	124 15.1	05/18/81	140
603354	coho	80	OAF	Oregon Aqua-Foods	127	43 31.7	124 15.8	06/17/81	121
603354	coho	80	OAF	Oregon Aqua-Foods	180	45 55.4	124 08.2	07/13/81	161
603360	coho	80	OAF	Oregon Aqua-Foods	104	44 40.0	124 31.7	06/14/81	124
603361	coho	80	OAF	Oregon Aqua-Foods	190	44 38.6	124 19.6	07/17/81	167
603361	coho	80	OAF	Oregon Aqua-Foods	191	44 38.2	124 20.3	07/17/81	181
603361	coho	80	OAF	Oregon Aqua-Foods	234	45 55.7	124 07.9	08/13/81	191
603403	coho	80	OAF	Oregon Aqua-Foods	243	44 38.3	124 06.3	08/15/81	144
603411	coho	80	OAF	Oregon Aqua-Foods	190	44 38.6	124 19.6	07/17/81	153
603412	coho	80	OAF	Oregon Aqua-Foods	193	44 38.2	124 25.1	07/17/81	139
603425	coho	80	OAF	Oregon Aqua-Foods	191	44 38.2	124 20.3	07/17/81	170
622203	coho	79	ANAD	Anadromous, Inc.	127	43 31.7	124 15.8	06/17/81	173
622203	coho	79	ANAD	Anadromous, Inc.	275	44 01.2	124 13.2	08/19/81	337
622403	coho	79	ANAD	Anadromous, Inc.	180	45 55.4	124 08.2	07/13/81	195
622603	coho	79	ANAD	Anadromous, Inc.	124	43 21.5	124 24.4	06/16/81	156
622603	coho	79	ANAD	Anadromous, Inc.	177	45 55.0	124 08.2	07/13/81	223
622703	coho	79	ANAD	Anadromous, Inc.	127	43 31.7	124 15.8	06/17/81	169
622804	coho	79	ANAD	Anadromous, Inc.	127	43 31.7	124 15.8	06/17/81	179
623504	coho	79	ANAD	Anadromous, Inc.	250	44 38.3	124 14.1	08/15/81	230
624704	coho	79	ANAD	Anadromous, Inc.	80	46 10.0	124 07.1	06/10/81	199
631634	coho	78	WDF	Puyallup	140	46 35.1	124 07.5	07/09/81	468
631909	coho	78	WDF	Wild Fish	194	44 38.3	124 32.4	07/17/81	564
631954	coho	78	WDF	Washougal	41	46 10.0	124 12.7	05/21/81	344
631954	coho	78	WDF	Washougal	84	46 10.0	124 27.1	06/11/81	417
631954	coho	78	WDF	Washougal	227	46 09.9	124 12.5	08/12/81	486
631954	coho	78	WDF	Washougal	181	45 55.4	124 08.2	07/14/81	505
631954	coho	78	WDF	Washougal	41	46 10.0	124 12.7	05/21/81	442
631954	coho	78	WDF	Washougal	173	46 20.0	124 18.5	07/13/81	567
632037	coho	78	WDF	Washougal	153	46 10.2	124 12.6	07/11/81	495
632037	coho	78	WDF	Washougal	181	45 55.4	124 08.2	07/14/81	585
632038	coho	78	WDF	Washougal	6	44 38.1	124 17.6	05/16/81	507
632038	coho	78	WDF	Washougal	41	46 10.0	124 12.7	05/21/81	466
632038	coho	78	WDF	Washougal	77	46 20.1	124 18.3	06/10/81	390
632038	coho	78	WDF	Washougal	227	46 09.9	124 12.5	08/12/81	427
632038	coho	78	WDF	Washougal	225	46 09.5	124 19.3	08/12/81	443
632049	coho	78	WDF	Fox Is. Pens	173	46 20.0	124 18.5	07/13/81	502
632106	coho	79	WDF	Grays R.	10	44 38.3	124 17.8	05/18/81	159
632106	coho	79	WDF	Grays R.	30	45 55.1	124 12.5	05/20/81	135
632106	coho	79	WDF	Grays R.	42	46 10.0	124 08.3	05/21/81	132
632119	coho	78	COOP	Seattle Aquarium	154	46 09.8	124 12.4	07/11/81	414
632150	coho	79	WDF	Washougal	30	45 55.1	124 12.5	05/20/81	134
632151	coho	79	WDF	Washougal	79	46 20.0	124 12.0	06/10/81	139
632151	coho	79	WDF	Washougal	227	46 09.9	124 12.5	08/12/81	224
632203	coho	79	WDF	Washougal	233	45 55.3	124 12.8	08/12/81	256
632203	coho	79	WDF	Washougal	224	46 09.5	124 19.3	08/12/81	262
632243	coho	79	WDF	Grays R.	183	45 55.0	124 20.2	07/14/81	240
050758	steelhead	80	FWS	Quinault NFH	72	46 35.0	124 18.2	06/09/81	172
102252	steelhead	80	IDFG	Dworshak NFH	35	46 10.0	124 28.0	05/21/81	206
				1982					
031733	chinook	80	NMFS	McNary (M)	129	45 20.4	124 12.0	06/22/82	355
050639	chinook	80	IDFG	Dworshak NFH	57	45 00.9	124 04.9	06/01/82	183
051041	chinook	80	YAKI	Nile Spring	62	44 40.7	124 24.4	06/01/82	173
066133	chinook	79	CDFG	Trinity R.	36	45 59.8	124 16.9	05/27/82	519
072054	chinook	80	ODFW	McKenzie	91	46 22.9	124 26.8	06/11/82	280
072141	chinook	80	ODFW	Bonneville	59	45 00.6	124 07.7	06/01/82	306
072143	chinook	80	ODFW	Bonneville	89	46 22.7	124 15.6	06/11/82	227
072143	chinook	80	ODFW	Bonneville	129	45 20.4	124 12.0	06/22/82	284

Appendix (continued)

Release data					Recovery data				
Tag code	Species	Brood year	Agency	Hatchery	Set	Latitude	Longitude	Date	Length (mm)
				1982 (continued)					
072350	chinook	80	ODFW	Round Butte	34	46 00.3	124 10.0	05/27/82	192
072350	chinook	80	ODFW	Round Butte	51	45 20.1	124 19.4	05/31/82	191
072350	chinook	80	ODFW	Round Butte	59	45 00.6	124 07.7	06/01/82	302
072350	chinook	80	ODFW	Round Butte	81	46 40.9	124 29.2	06/08/82	287
072419	chinook	80	ODFW	Willamette	79	46 40.7	124 17.8	06/08/82	247
072419	chinook	80	ODFW	Willamette	86	46 30.0	124 25.0	06/10/82	287
072422	chinook	80	ODFW	Willamette	87	46 30.3	124 18.0	06/10/82	260
072502	chinook	80	ODFW	Rock Creek	67	44 19.7	124 12.4	06/02/82	248
072507	chinook	80	ODFW	Bonneville	56	45 00.4	124 15.0	05/31/82	289
072518	chinook	80	ODFW	McKenzie	34	46 00.3	124 10.0	05/27/82	207
072524	chinook	80	ODFW	Marion Forks	82	46 40.2	124 19.4	06/10/82	150
072525	chinook	80	ODFW	Marion Forks	86	46 30.0	124 25.0	06/10/82	210
072526	chinook	80	ODFW	Marion Forks	82	46 40.2	124 19.4	06/10/82	193
072527	chinook	80	ODFW	Marion Forks	62	44 40.7	124 24.4	06/01/82	179
072527	chinook	80	ODFW	Marion Forks	81	46 40.9	124 29.2	06/08/82	165
072528	chinook	80	ODFW	Marion Forks	35	46 00.0	124 10.0	05/27/82	213
072529	chinook	80	ODFW	Marion Forks	36	45 59.8	124 16.9	05/27/82	186
072529	chinook	80	ODFW	Marion Forks	87	46 30.3	124 18.0	06/10/82	228
072536	chinook	80	ODFW	Elk R.	56	45 00.4	124 15.0	05/31/82	316
102412	chinook	80	IDFG	McCall	86	46 30.0	124 25.0	06/10/82	168
102413	chinook	80	IDFG	McCall	34	46 00.3	124 10.0	05/27/82	139
102413	chinook	80	IDFG	McCall	81	46 40.9	124 29.2	06/08/82	140
624832	chinook	80	DOMS	Domsea	22	46 40.4	124 18.2	05/23/82	270
624832	chinook	80	DOMS	Domsea	82	46 40.2	124 19.4	06/10/82	309
632307	chinook	80	WDF	Soleduck	20	46 59.9	124 31.9	05/22/82	203
632310	chinook	80	WDF	Cowlitz	173	44 18.6	124 10.4	09/14/82	340
632311	chinook	80	WDF	Cowlitz	33	46 00.4	124 03.6	05/27/82	159
050757	coho	79	TULA	Tulalip	45	45 40.6	124 10.4	05/30/82	399
050845	coho	80	QDNR	Wild	62	44 40.7	124 24.4	06/01/82	143
051019	coho	80	QDNR	Wild	72	47 20.3	124 39.3	06/07/82	127
051035	coho	80	FWS	Eagle Cr. NFH	131	47 19.8	124 31.7	09/04/82	373
051035	coho	80	FWS	Eagle Cr. NFH	59	45 00.6	124 07.7	06/01/82	156
051036	coho	80	FWS	Eagle Cr. NFH	86	46 30.0	124 25.0	06/10/82	147
051037	coho	80	FWS	Eagle Cr. NFH	58	45 00.3	124 05.2	06/01/82	146
051038	coho	80	FWS	Eagle Cr. NFH	101	45 50.3	124 14.7	06/13/82	204
051038	coho	80	FWS	Eagle Cr. NFH	130	45 20.6	124 19.7	06/22/82	156
051039	coho	80	FWS	Eagle Cr. NFH	127	45 20.1	124 26.3	06/21/82	156
051039	coho	80	FWS	Eagle Cr. NFH	143	46 40.4	124 22.1	09/06/82	317
051040	coho	80	FWS	Eagle Cr. NFH	58	45 00.3	124 05.2	06/01/82	147
071310	coho	80	ODFW	Big Creek	130	45 20.6	124 19.7	06/22/82	193
071511	coho	80	ODFW	Big Creek	59	45 00.6	124 07.7	06/01/82	153
072263	coho	79	ODFW	Sandy	41	46 07.6	124 29.0	05/28/82	480
072403	coho	80	ODFW	Rock Creek	61	44 40.9	124 17.7	06/01/82	193
072403	coho	80	ODFW	Rock Creek	124	45 00.0	124 22.1	06/20/82	198
072404	coho	80	ODFW	Rock Creek	123	45 00.0	124 22.1	06/20/82	205
072406	coho	80	ODFW	Fall Cr.	108	45 20.4	124 12.9	06/16/82	210
072427	coho	80	ODFW	Cascade	131	47 19.8	124 31.7	09/04/82	279
072432	coho	80	ODFW	Cascade	125	45 20.6	124 26.2	06/21/82	160
072434	coho	80	ODFW	Cascade	131	47 19.8	124 31.7	09/04/82	320
072455	coho	80	ODFW	Salmon R.	107	45 20.4	124 12.3	06/16/82	162
072456	coho	80	ODFW	Salmon R.	59	45 00.6	124 07.7	06/01/82	147
072456	coho	80	ODFW	Salmon R.	130	45 20.6	124 19.7	06/22/82	212
072458	coho	80	ODFW	Siletz	107	45 20.4	124 12.3	06/16/82	204
072458	coho	80	ODFW	Siletz	150	46 20.1	124 18.2	09/07/82	352
072458	coho	80	ODFW	Siletz	160	45 40.0	124 00.8	09/09/82	336
072508	coho	80	ODFW	Butte Falls	112	44 40.2	124 31.5	06/18/82	165
072534	coho	80	ODFW	Fall Cr.	107	45 20.4	124 12.3	06/16/82	274
072534	coho	80	ODFW	Fall Cr.	108	45 20.4	124 12.9	06/16/82	200

Appendix (continued)

Release data					Recovery data				
Tag code	Species	Brood year	Agency	Hatchery	Set	Latitude	Longitude	Date	Length (mm)
				1982 (continued)					
072549	coho	80	ODFW	Sandy	150	46 20.1	124 18.2	09/07/82	268
072550	coho	80	ODFW	Sandy	150	46 20.1	124 18.2	09/07/82	353
072556	coho	80	ODFW	Sandy	59	45 00.6	124 07.7	06/01/82	153
072556	coho	80	ODFW	Sandy	61	44 40.9	124 17.7	06/01/82	163
072557	coho	80	ODFW	Sandy	59	45 00.6	124 07.7	06/01/82	152
072557	coho	80	ODFW	Sandy	59	45 00.6	124 07.7	06/01/82	150
072557	coho	80	ODFW	Sandy	108	45 20.4	124 12.9	06/16/82	163
072558	coho	80	ODFW	Sandy	123	45 00.0	124 22.1	06/20/82	174
072648	coho	80	ODFW	Big Creek	130	45 20.6	124 19.7	06/22/82	173
072649	coho	80	ODFW	Big Creek	58	45 00.3	124 05.2	06/01/82	142
090211	coho	80	ODFW	Big Creek	62	44 40.7	124 24.4	06/01/82	188
600516	coho	81	OAF	Oregon Aqua-Foods	155	45 56.3	124 06.7	09/08/82	246
600533	coho	81	OAF	Oregon Aqua-Foods	150	46 20.1	124 18.2	09/07/82	242
600540	coho	81	OAF	Oregon Aqua-Foods	154	45 56.3	124 02.9	09/08/82	184
600540	coho	81	OAF	Oregon Aqua-Foods	172	44 19.1	124 10.7	09/14/82	204
600541	coho	81	OAF	Oregon Aqua-Foods	163	45 20.7	124 05.3	09/12/82	186
600542	coho	81	OAF	Oregon Aqua-Foods	116	44 40.2	124 10.7	09/11/82	157
600555	coho	81	OAF	Oregon Aqua-Foods	154	45 56.3	124 02.9	09/08/82	245
600560	coho	81	OAF	Oregon Aqua-Foods	151	46 20.1	124 17.7	09/08/82	182
603423	coho	80	OAF	Oregon Aqua-Foods	171	44 19.9	124 12.6	09/14/82	552
604148	coho	80	OAF	Oregon Aqua-Foods	171	44 19.9	124 12.6	09/14/82	408
632130	coho	79	SQAX	Squaxin Is. Pens	22	46 40.4	124 18.2	05/23/82	444
632130	coho	79	SQAX	Squaxin Is. Pens	41	46 07.6	124 29.0	05/28/82	433
632139	coho	79	WDF	Green R.	19	47 00.0	124 24.9	05/22/82	460
632203	coho	79	WDF	Washougal	47	45 40.3	124 24.6	05/30/82	518
632249	coho	80	WDF	Wild	81	46 40.9	124 29.2	06/08/82	168
632303	coho	80	WDF	Lower Kalama	59	45 00.6	124 07.7	06/01/82	164
632303	coho	80	WDF	Lower Kalama	59	45 00.6	124 07.7	06/01/82	160
632303	coho	80	WDF	Lower Kalama	59	45 00.6	124 07.7	06/01/82	169
632303	coho	80	WDF	Lower Kalama	59	45 00.6	124 07.7	06/01/82	161
632303	coho	80	WDF	Lower Kalama	108	45 20.4	124 12.9	06/16/82	205
632304	coho	80	WDF	Speelyai	59	45 00.6	124 07.7	06/01/82	148
632305	coho	80	WDF	Speelyai	131	47 19.8	124 31.7	09/04/82	330
632313	coho	79	WDF	Wild	104	45 40.6	124 10.3	06/14/82	455
632357	coho	80	WDF	Wild	77	47 00.3	124 24.8	06/07/82	150
632358	coho	80	WDF	Wild	87	46 30.3	124 18.0	06/10/82	128
632363	coho	80	WDF	Grays R.	57	45 00.9	124 04.9	06/01/82	161
632401	coho	80	WDF	Naselle R.	82	46 40.2	124 19.4	06/10/82	224
632402	coho	80	WDF	Nemah	78	47 00.3	124 24.8	06/07/82	165
632402	coho	80	WDF	Nemah	79	46 40.7	124 17.8	06/08/82	133
632402	coho	80	WDF	Nemah	107	45 20.4	124 12.3	06/16/82	145
632404	coho	80	WDF	Humptulips	82	46 40.2	124 19.4	06/10/82	150
632404	coho	80	WDF	Humptulips	88	46 29.8	124 17.5	06/10/82	149
632408	coho	80	WDF	Simpson	56	45 00.4	124 15.0	06/01/82	133
632408	coho	80	WDF	Simpson	88	46 29.8	124 17.5	06/10/82	133
632409	coho	80	WDF	Willapa	78	47 00.3	124 24.8	06/07/82	160
632415	coho	80	WDF	Wild	86	46 30.0	124 25.0	06/10/82	167
632423	coho	80	WDF	Cowlitz	56	45 00.4	124 15.0	05/31/82	141
632427	coho	80	WDF	Cowlitz	59	45 00.6	124 07.7	06/01/82	164
632436	coho	80	WDF	Cowlitz	58	45 00.3	124 05.2	06/01/82	136
632436	coho	80	WDF	Cowlitz	59	45 00.6	124 07.7	06/01/82	158
632437	coho	80	WDF	Cowlitz	107	45 20.4	124 12.3	06/16/82	164
632438	coho	80	WDF	Cowlitz	130	45 20.6	124 19.7	06/22/82	141
632439	coho	80	WDF	Cowlitz	59	45 00.6	124 07.7	06/01/82	149
632446	coho	80	WDF	Cowlitz	39	46 09.3	124 19.1	05/28/82	138
632448	coho	80	WDF	Cowlitz	131	47 19.8	124 31.7	09/04/82	316
632449	coho	80	WDF	Cowlitz	131	47 19.8	124 31.7	09/04/82	332
632516	coho	80	WDF	Washougal	102	45 39.6	124 01.6	06/13/82	136

Appendix (continued)

Release data					Recovery data				
Tag code	Species	Brood year	Agency	Hatchery	Set	Latitude	Longitude	Date	Length (mm)
				1982 (continued)					
632518	coho	80	WDF	Washougal	90	46 23.1	124 18.2	06/11/82	137
632519	coho	80	WDF	Washougal	123	45 00.0	124 22.1	06/20/82	155
632526	coho	80	WDF	Washougal	125	45 20.6	124 26.2	06/21/82	165
632529	coho	80	WDF	Washougal	104	45 40.6	124 10.3	06/14/82	146
632530	coho	80	WDF	Washougal	150	46 20.1	124 18.2	09/07/82	270
632548	coho	80	WDF	Wild	81	46 40.9	124 29.2	06/08/82	144
051043	steelhead	81	HOH	Quinault lake	52	45 20.9	124 25.8	05/31/82	185
				1983					
051122	chinook	81	FWS	Quinault NFH	75	48 00.2	124 48.1	06/15/83	238
051339	chinook	81	YAKI	Leavenworth NFH	30	46 19.8	124 25.9	05/21/83	152
072547	chinook	81	ODFW	Bonneville	8	48 00.0	124 55.8	05/17/83	254
072836	chinook	82	ODFW	Round Butte	63	46 40.8	124 11.5	06/12/83	124
102318	chinook	81	IDFG	Rapid River	26	46 40.2	124 32.7	05/20/83	158
102458	chinook	81	IDFG	McCall	39	45 40.9	124 10.6	05/23/83	146
632505	chinook	81	WDF	Cowlitz	28	46 20.7	124 11.4	05/21/83	225
632609	chinook	81	WDF	Cowlitz	28	46 20.7	124 11.4	05/21/83	224
632609	chinook	81	WDF	Cowlitz	28	46 20.7	124 11.4	05/21/83	254
050929	coho	81	FWS	Willard NFH	90	46 00.1	124 05.6	06/23/83	134
050938	coho	81	FWS	Willard NFH	95	45 40.0	123 59.6	06/23/83	145
051062	coho	80	TULA	Tulalip Cr.	5	48 20.4	125 09.5	05/16/83	370
051136	coho	81	FWS	Eagle Creek NFH	66	46 40.0	124 26.3	06/13/83	195
051137	coho	81	FWS	Eagle Creek NFH	39	45 40.9	124 10.6	05/23/83	153
072445	coho	81	ODFW	Fall Creek	32	46 19.8	124 25.0	05/21/83	170
072449	coho	81	ODFW	Klaskanine	39	45 40.9	124 10.6	05/23/83	173
072450	coho	81	ODFW	Siletz	68	47 00.0	124 32.3	06/13/83	222
072456	coho	80	ODFW	Salmon River	14	47 40.4	124 34.5	05/18/83	544
072544	coho	80	ODFW	Cole Rivers	34	46 00.3	124 06.0	05/22/83	444
072559	coho	81	ODFW	Nehalem	87	46 00.4	124 01.4	06/23/83	325
072561	coho	81	ODFW	Nehalem	28	46 20.7	124 11.4	05/21/83	200
072561	coho	81	ODFW	Nehalem	80	47 40.0	124 37.5	06/15/83	233
072639	coho	81	ODFW	Rock Creek	107	43 27.5	124 19.0	06/23/83	315
072642	coho	81	ODFW	Fall Creek	59	44 19.8	124 33.4	05/27/83	173
072642	coho	81	ODFW	Fall Creek	66	46 40.0	124 26.3	06/13/83	190
072735	coho	81	ODFW	Sandy	34	46 00.3	124 06.0	05/23/83	146
600533	coho	81	OAF	Oregon Aqua-Foods	69	47 00.0	124 24.0	06/13/83	400
600548	coho	82	OAF	Oregon Aqua-Foods	122	48 20.0	124 50.8	09/15/83	272
600617	coho	82	OAF	Oregon Aqua-Foods	149	45 40.0	124 03.1	09/20/83	232
603556	coho	82	OAF	Oregon Aqua-Foods	155	45 20.2	124 01.3	09/22/83	198
603557	coho	82	OAF	Oregon Aqua-Foods	149	45 40.0	124 03.1	09/20/83	206
603559	coho	82	OAF	Oregon Aqua-Foods	163	44 40.0	124 06.7	09/23/83	152
621521	coho	81	ANAD	Anadromous, Inc.	109	43 27.5	124 30.1	06/26/83	157
621521	coho	81	ANAD	Anadromous, Inc.	109	43 27.5	124 30.1	06/26/83	144
621521	coho	81	ANAD	Anadromous, Inc.	110	43 27.5	124 30.1	06/26/83	153
621522	coho	81	ANAD	Anadromous, Inc.	109	43 27.5	124 30.1	06/26/83	158
621522	coho	81	ANAD	Anadromous, Inc.	110	43 27.5	124 30.1	06/26/83	151
621526	coho	81	ANAD	Anadromous, Inc.	111	43 27.6	124 36.4	06/26/83	167
621532	coho	81	ANAD	Anadromous, Inc.	110	43 27.5	124 30.1	06/26/83	147
621532	coho	81	ANAD	Anadromous, Inc.	110	43 27.5	124 30.1	06/26/83	152
621533	coho	81	ANAD	Anadromous, Inc.	110	43 27.5	124 30.1	06/26/83	151
621533	coho	81	ANAD	Anadromous, Inc.	110	43 27.5	124 30.1	06/26/83	174
621534	coho	81	ANAD	Anadromous, Inc.	109	43 27.5	124 30.1	06/26/83	148
621534	coho	81	ANAD	Anadromous, Inc.	109	43 27.5	124 30.1	06/26/83	167
621534	coho	81	ANAD	Anadromous, Inc.	109	43 27.5	124 30.1	06/26/83	161
621534	coho	81	ANAD	Anadromous, Inc.	110	43 27.5	124 30.1	06/26/83	155
621535	coho	81	ANAD	Anadromous, Inc.	110	43 27.5	124 30.1	06/26/83	153
621535	coho	81	ANAD	Anadromous, Inc.	111	43 27.6	124 36.4	06/26/83	159
621535	coho	81	ANAD	Anadromous, Inc.	110	43 27.5	124 30.1	06/26/83	160

Appendix (continued)

Release data					Recovery data				
Tag code	Species	Brood year	Agency	Hatchery	Set	Latitude	Longitude	Date	Length (mm)
				1983 (continued)					
632334	coho	80	WDF	Wild	13	47 40.5	124 37.6	05/17/83	435
632334	coho	80	WDF	Wild	5	48 20.4	125 09.5	05/16/83	392
632445	coho	80	WDF	Cowlitz	8	48 00.0	124 55.8	05/17/83	394
632529	coho	80	WDF	Washougal	61	46 29.7	124 21.5	06/09/83	468
632605	coho	81	WDF	Lower Kalama	61	46 29.7	124 21.5	09/06/83	203
632605	coho	81	WDF	Lower Kalama	66	46 40.0	124 26.3	06/13/86	210
632632	coho	81	WDF	Cowlitz	37	45 40.5	123 59.1	05/23/83	134
632645	coho	81	WDF	Washougal	61	46 29.7	124 21.5	09/06/83	198
				1984					
050859	chinook	82	FWS	Carson NFH	13	47 40.1	125 01.3	06/06/84	179
050860	chinook	82	FWS	Carson NFH	17	47 20.1	124 39.0	06/08/84	168
050916	chinook	82	FWS	Carson NFH	26	46 20.0	124 13.0	06/10/84	180
050918	chinook	82	FWS	Carson NFH	10	47 39.7	124 39.0	06/06/84	165
051140	chinook	82	FWS	Little White Salmon	14	47 20.1	124 47.0	06/06/84	170
051528	chinook	83	FWS	Leavenworth NFH	111	46 59.6	124 19.3	07/28/84	138
072840	chinook	82	ODFW	Round Butte	13	47 40.1	125 01.3	06/06/84	205
072858	chinook	82	ODFW	Big Creek	147	47 59.7	124 55.6	09/01/84	389
072863	chinook	82	ODFW	Marion Forks	17	47 20.1	124 39.0	06/08/84	164
102413	chinook	80	IDGF	McCall	33	45 59.5	124 17.0	06/12/84	856
102607	chinook	83	IDGF	Hagerman NFH	26	46 20.0	124 13.0	06/10/84	149
102738	chinook	82	IDGF	McCall	148	47 59.7	124 49.2	09/01/84	236
102738	chinook	82	IDGF	McCall	19	47 00.0	124 32.0	06/08/84	164
102738	chinook	82	IDGF	McCall	26	46 20.0	124 13.0	06/10/84	148
102738	chinook	82	IDGF	McCall	140	48 20.3	124 48.5	09/01/84	267
621761	chinook	83	ANAD	Anadromous	205	44 00.1	124 11.1	09/15/84	211
621761	chinook	83	ANAD	Anadromous	196	44 40.0	124 07.2	09/14/84	213
621761	chinook	83	ANAD	Anadromous	196	44 40.0	124 07.2	09/14/84	217
632156	chinook	80	WDF	Cowlitz	126	48 58.0	125 41.8	08/01/84	601
632834	chinook	82	WDF	Cowlitz	36	45 40.1	124 03.2	06/12/84	214
632844	chinook	82	WDF	Rocky Reach	36	45 40.1	124 03.2	06/12/84	186
632844	chinook	82	WDF	Rocky Reach	23	46 39.6	124 19.5	06/09/84	150
632844	chinook	82	WDF	Rocky Reach	115	46 59.1	124 39.2	07/29/84	223
022463	coho	82	CDFO	San Juan River CDP	7	48 00.4	124 55.1	06/05/84	155
051119	coho	81	FWS	Quilcene NFH	126	48 58.0	125 41.8	08/01/84	541
072615	coho	82	ODFW	Cole Rivers	72	40 45.1	124 19.6	07/10/84	200
072637	coho	82	ODFW	Wahkeena Pond	119	47 29.9	124 41.2	07/29/84	269
072638	coho	81	ODFW	Rock Creek	60	44 20.6	124 09.5	06/19/84	582
072746	coho	81	ODFW	Cascade	39	45 19.8	124 05.5	06/13/84	505
072854	coho	82	ODFW	Cole Rivers	71	40 31.7	124 28.8	07/09/84	191
072945	coho	82	ODFW	Cascade	142	48 20.8	124 59.9	09/01/84	293
072949	coho	82	ODFW	Cascade	35	45 40.1	124 10.4	06/12/84	162
073014	coho	82	ODFW	Bonneville	160	47 00.0	124 32.1	09/03/84	259
231703	coho	82	NMFS	Priest Rapids (M)	18	47 00.0	124 39.6	06/08/84	176
603609	coho	82	OAF	Oregon Aqua-Foods	94	44 59.6	124 08.2	07/25/84	498
603633	coho	83	OAF	Oregon Aqua-Foods	41	45 20.3	124 19.5	06/14/84	143
603644	coho	83	OAF	Oregon Aqua-Foods	167	46 39.9	124 25.7	09/04/84	197
621742	coho	82	ANAD	Anadromous, Inc.	165	46 40.0	124 18.7	09/04/84	260
632554	coho	81	WDF	Green River	125	48 33.4	124 55.1	07/30/84	462
632561	coho	81	COOP	George Adams	122	48 00.0	124 55.9	07/30/84	534
632562	coho	81	COOP	Port Gamble Pens	125	48 33.4	124 55.1	07/30/84	539
632730	coho	81	WDF	Skykomish	8	48 00.0	124 49.0	06/05/84	485
632739	coho	82	WDF	Soleduck	18	47 00.0	124 39.6	06/08/84	160
632742	coho	82	WDF	Naselle	18	47 00.0	124 39.6	06/08/84	168
632742	coho	82	WDF	Naselle	20	47 00.0	124 24.5	06/08/84	158
632746	coho	82	WDF	Simpson	16	47 20.0	124 32.0	06/08/84	135
632921	coho	82	WDF	Cowlitz	97	45 30.1	124 01.8	07/26/84	245
632924	coho	82	WDF	Cowlitz	41	45 20.3	124 19.5	06/14/84	168

Appendix (continued)

Release data					Recovery data				
Tag code	Species	Brood year	Agency	Hatchery	Set	Latitude	Longitude	Date	Length (mm)
				1984 (continued)					
632945	coho	82	WDF	Washougal	161	47 00.4	124 39.1	09/03/84	303
632946	coho	82	WDF	Washougal	163	47 00.3	124 31.9	09/03/84	269
632957	coho	82	WDF	Washougal	47	44 59.4	124 22.4	06/16/84	145
632960	coho	82	WDF	Washougal	170	46 20.4	124 17.9	09/05/84	289
632961	coho	82	WDF	Washougal	163	47 00.3	124 31.9	09/03/84	280
633016	coho	82	WDF	Speelyai	46	45 00.0	124 14.9	06/16/84	157
633027	coho	82	WDF	Wild	146	47 59.7	125 03.2	09/01/84	266
051335	steelhead	83	FWS	Dworshak	27	46 20.0	124 33.8	06/10/84	194
				1985					
051155	chinook	83	FWS	Carson NFH	6	45 58.9	124 25.1	05/30/85	169
051158	chinook	83	FWS	Carson NFH	1	46 20.1	124 11.1	05/29/85	142
051158	chinook	83	FWS	Carson NFH	30	46 19.9	124 32.5	06/05/85	159
051159	chinook	83	FWS	Carson NFH	1	46 20.1	124 11.1	05/29/85	155
051160	chinook	83	FWS	Carson NFH	1	46 20.1	124 11.1	05/29/85	142
051216	chinook	83	FWS	Carson NFH	1	46 20.1	124 11.1	05/29/85	159
051525	chinook	83	FWS	Spring Creek NFH	77	46 00.1	124 17.3	06/17/85	220
051527	chinook	83	FWS	Little White Salmon	1	46 20.1	124 11.1	05/29/85	177
051533	chinook	83	FWS	Leavenworth NFH	6	45 58.9	124 25.1	05/30/85	172
072749	chinook	83	ODFW	Rock Creek	49	44 19.9	124 07.0	06/11/85	276
072749	chinook	83	ODFW	Rock Creek	117	47 59.7	124 48.3	06/25/85	295
072902	chinook	83	ODFW	Marion Forks	1	46 20.1	124 11.1	05/29/85	168
073007	chinook	83	ODFW	Bonneville	1	46 20.1	124 11.1	05/29/85	187
073007	chinook	83	ODFW	Bonneville	1	46 20.1	124 11.1	05/29/85	219
073007	chinook	83	ODFW	Bonneville	1	46 20.1	124 11.1	05/29/85	230
073023	chinook	83	ODFW	Marion Forks	11	46 00.3	123 59.7	05/31/85	261
073127	chinook	83	ODFW	Bonneville	1	46 20.1	124 11.1	05/29/85	158
073127	chinook	83	ODFW	Bonneville	8	45 59.3	124 17.2	05/30/85	237
073128	chinook	83	ODFW	Round Butte	115	48 00.3	125 03.0	06/25/85	275
073155	chinook	83	ODFW	Lookingglass	1	46 20.1	124 11.1	05/29/85	158
073155	chinook	83	ODFW	Lookingglass	1	46 20.1	124 11.1	05/29/85	155
102518	chinook	83	IDFG	McCall	1	46 20.1	124 11.1	05/29/85	138
102518	chinook	83	IDFG	McCall	1	46 20.1	124 11.1	05/29/85	142
102518	chinook	83	IDFG	McCall	1	46 20.1	124 11.1	05/29/85	155
102523	chinook	83	UI	Eagle Creek NFH	1	46 20.1	124 11.1	05/29/85	147
102523	chinook	83	UI	Eagle Creek NFH	30	46 19.9	124 32.5	06/05/85	162
102524	chinook	83	UI	Eagle Creek NFH	1	46 20.1	124 11.1	05/29/85	145
102524	chinook	83	UI	Eagle Creek NFH	1	46 20.1	124 11.1	05/29/85	146
102524	chinook	83	UI	Eagle Creek NFH	1	46 20.1	124 11.1	05/29/85	166
102526	chinook	83	UI	Eagle Creek NFH	1	46 20.1	124 11.1	05/29/85	141
102526	chinook	83	UI	Eagle Creek NFH	1	46 20.1	124 11.1	05/29/85	170
102526	chinook	83	UI	Eagle Creek NFH	26	46 20.0	124 11.4	06/03/85	118
102532	chinook	83	UI	Eagle Creek NFH	15	46 05.8	124 00.8	05/31/85	149
102532	chinook	83	UI	Eagle Creek NFH	1	46 20.1	124 11.1	05/29/85	178
102532	chinook	83	UI	Eagle Creek NFH	1	46 20.1	124 11.1	05/29/85	170
102533	chinook	83	UI	Eagle Creek NFH	1	46 20.1	124 11.1	05/29/85	166
102533	chinook	83	UI	Eagle Creek NFH	1	46 20.1	124 11.1	05/29/85	164
102533	chinook	83	UI	Eagle Creek NFH	11	46 00.3	123 59.7	05/31/85	155
102533	chinook	83	UI	Eagle Creek NFH	3	46 10.0	124 04.6	05/30/85	210
102533	chinook	83	UI	Eagle Creek NFH	1	46 20.1	124 11.1	05/29/85	129
102533	chinook	83	UI	Eagle Creek NFH	1	46 20.1	124 11.1	05/29/85	200
102533	chinook	83	UI	Eagle Creek NFH	1	46 20.1	124 11.1	05/29/85	225
102533	chinook	83	UI	Eagle Creek NFH	1	46 20.1	124 11.1	05/29/85	149
102633	chinook	83	IDFG	McCall	1	46 20.1	124 11.1	05/29/85	140
102633	chinook	83	IDFG	McCall	1	46 20.1	124 11.1	05/29/85	135
231713	chinook	83	NMFS	Priest Rapids (M)	110	47 40.1	124 38.7	06/25/85	180
231713	chinook	83	NMFS	Priest Rapids (M)	6	45 58.9	124 25.1	05/30/85	160
231714	chinook	83	NMFS	Priest Rapids (M)	1	46 20.1	124 11.1	05/29/85	126

Appendix (continued)

Release data					Recovery data				
Tag code	Species	Brood year	Agency	Hatchery	Set	Latitude	Longitude	Date	Length (mm)
				1985 (continued)					
231748	chinook	83	NMFS	Priest Rapids (M)	110	47 40.1	124 38.7	06/25/85	180
231748	chinook	83	NMFS	Priest Rapids (M)	1	46 20.1	124 11.1	05/29/85	119
231753	chinook	83	NMFS	Priest Rapids (M)	27	46 19.6	124 18.4	06/03/85	149
231756	chinook	83	NMFS	Priest Rapids (M)	93	47 00.3	124 32.0	06/22/85	190
632152	chinook	83	WDF	Lyons Ferry	117	47 59.7	124 48.3	06/25/85	233
632152	chinook	83	WDF	Lyons Ferry	92	47 00.2	124 25.2	06/22/85	236
632152	chinook	83	WDF	Lyons Ferry	83	46 19.9	124 18.4	06/18/85	247
632152	chinook	83	WDF	Lyons Ferry	74	46 00.0	124 00.2	06/17/85	242
632152	chinook	83	WDF	Lyons Ferry	94	47 00.0	124 39.7	06/22/85	220
632152	chinook	83	WDF	Lyons Ferry	94	47 00.0	124 39.7	06/22/85	209
632152	chinook	83	WDF	Lyons Ferry	77	46 00.1	124 17.3	06/17/85	212
632152	chinook	83	WDF	Lyons Ferry	6	45 58.9	124 25.1	05/30/85	184
632152	chinook	83	WDF	Lyons Ferry	14	46 00.2	124 03.3	05/31/85	197
632152	chinook	83	WDF	Lyons Ferry	15	46 05.8	124 00.8	05/31/85	176
632152	chinook	83	WDF	Lyons Ferry	67	45 40.3	123 58.6	06/14/85	220
632152	chinook	83	WDF	Lyons Ferry	1	46 20.1	124 11.1	05/29/85	188
632152	chinook	83	WDF	Lyons Ferry	117	47 59.7	124 48.3	06/25/85	215
632152	chinook	83	WDF	Lyons Ferry	1	46 20.1	124 11.1	05/29/85	187
632152	chinook	83	WDF	Lyons Ferry	1	46 20.1	124 11.1	05/29/85	199
632152	chinook	83	WDF	Lyons Ferry	1	46 20.1	124 11.1	05/29/85	194
632152	chinook	83	WDF	Lyons Ferry	1	46 20.1	124 11.1	05/29/85	170
632152	chinook	83	WDF	Lyons Ferry	1	46 20.1	124 11.1	05/29/85	215
632326	chinook	83	WDF	Wells Channel	1	46 20.1	124 11.1	05/29/85	189
632747	chinook	83	WDF	Cowlitz	88	46 20.0	124 11.0	06/20/85	237
632747	chinook	83	WDF	Cowlitz	15	46 05.8	124 00.8	05/31/85	220
632747	chinook	83	WDF	Cowlitz	15	46 05.8	124 00.8	05/31/85	230
632747	chinook	83	WDF	Cowlitz	11	46 00.3	123 59.7	05/31/85	210
632747	chinook	83	WDF	Cowlitz	1	46 20.1	124 11.1	05/29/85	206
632747	chinook	83	WDF	Cowlitz	1	46 20.1	124 11.1	05/29/85	207
632747	chinook	83	WDF	Cowlitz	1	46 20.1	124 11.1	05/29/85	182
632748	chinook	83	WDF	Cowlitz	89	46 20.4	124 19.0	06/20/85	232
632748	chinook	83	WDF	Cowlitz	55	44 39.8	124 18.2	06/12/85	198
632748	chinook	83	WDF	Cowlitz	11	46 00.3	123 59.7	05/31/85	229
632748	chinook	83	WDF	Cowlitz	9	46 21.0	124 10.0	05/31/85	205
632748	chinook	83	WDF	Cowlitz	12	45 59.9	124 03.2	05/31/85	213
632748	chinook	83	WDF	Cowlitz	1	46 20.1	124 11.1	05/29/85	175
632748	chinook	83	WDF	Cowlitz	19	46 00.3	123 59.5	06/01/85	179
632836	chinook	82	WDF	Cowlitz	1	46 20.1	124 11.1	05/29/85	462
632857	chinook	83	WDF	Rocky Reach	9	46 21.0	124 10.0	05/31/85	170
632857	chinook	83	WDF	Rocky Reach	89	46 20.4	124 19.0	06/20/85	196
632857	chinook	83	WDF	Rocky Reach	88	46 20.0	124 11.0	06/20/85	190
632857	chinook	83	WDF	Rocky Reach	105	47 20.1	124 46.7	06/24/85	228
632857	chinook	83	WDF	Rocky Reach	1	46 20.1	124 11.1	05/29/85	186
632857	chinook	83	WDF	Rocky Reach	1	46 20.1	124 11.1	05/29/85	182
632857	chinook	83	WDF	Rocky Reach	1	46 20.1	124 11.1	05/29/85	175
632857	chinook	83	WDF	Rocky Reach	1	46 20.1	124 11.1	05/29/85	184
633054	chinook	83	WDF	Cowlitz	1	46 20.1	124 11.1	05/29/85	190
633055	chinook	83	WDF	Cowlitz	89	46 20.4	124 19.0	06/20/85	237
633055	chinook	83	WDF	Cowlitz	14	46 00.2	124 03.3	05/31/85	215
633055	chinook	83	WDF	Cowlitz	1	46 20.1	124 11.1	05/29/85	202
633056	chinook	83	WDF	Cowlitz	3	46 10.0	124 04.6	05/30/85	195
633056	chinook	83	WDF	Cowlitz	1	46 20.1	124 11.1	05/29/85	215
633117	chinook	83	WDF	Washougal	1	46 20.1	124 11.1	05/29/85	147
633122	chinook	83	WDF	Cowlitz	1	46 20.1	124 11.1	05/29/85	194
633122	chinook	83	WDF	Cowlitz	1	46 20.1	124 11.1	05/29/85	204
633122	chinook	83	WDF	Cowlitz	1	46 20.1	124 11.1	05/29/85	223
633218	chinook	83	WDF	Lyons Ferry	110	47 40.1	124 38.7	06/25/85	220
633218	chinook	83	WDF	Lyons Ferry	93	47 00.3	124 32.0	06/22/85	216

Appendix (continued)

Release data					Recovery data				
Tag code	Species	Brood year	Agency	Hatchery	Set	Latitude	Longitude	Date	Length (mm)
				1985 (continued)					
633218	chinook	83	WDF	Lyons Ferry	117	47 59.7	124 48.3	06/25/85	221
633218	chinook	83	WDF	Lyons Ferry	83	46 19.9	124 18.4	06/18/85	220
633218	chinook	83	WDF	Lyons Ferry	94	47 00.0	124 39.7	06/22/85	241
633218	chinook	83	WDF	Lyons Ferry	1	46 20.1	124 11.1	05/29/85	177
633218	chinook	83	WDF	Lyons Ferry	1	46 20.1	124 11.1	05/29/85	175
633218	chinook	83	WDF	Lyons Ferry	8	45 59.3	124 17.2	05/30/85	183
h50606	chinook	83	FWS	Spring Creek NFH	82	46 19.4	124 10.8	06/18/85	354
022458	coho	82	CDFO	Thornton Cr. CDP	92	47 00.2	124 25.2	06/22/85	530
022651	coho	82	CDFO	Tenderfoot Cr.	89	46 20.4	124 19.0	06/20/85	445
022723	coho	82	CDFO	Puntledge R.	105	47 20.1	124 46.7	06/24/85	495
072654	coho	83	ODFW	Bonneville	68	45 40.4	124 03.3	06/14/85	164
072756	coho	83	ODFW	Butte Falls	30	46 19.9	124 32.5	06/05/85	200
072756	coho	83	ODFW	Butte Falls	12	45 59.9	124 03.2	05/31/85	207
072761	coho	83	ODFW	Rock Creek	111	47 40.3	124 46.1	06/25/85	264
072762	coho	83	ODFW	Rock Creek	52	44 39.7	124 17.5	06/12/85	185
072763	coho	83	ODFW	Salmon River	111	47 40.3	124 46.1	06/25/85	263
072763	coho	83	ODFW	Salmon River	95	47 00.2	124 46.6	06/22/85	233
072763	coho	83	ODFW	Salmon River	12	45 59.9	124 03.2	05/31/85	214
072801	coho	83	ODFW	Klaskanine	94	47 00.0	124 39.7	06/22/85	204
072801	coho	83	ODFW	Klaskanine	11	46 00.3	123 59.7	05/31/85	186
072801	coho	83	ODFW	Klaskanine	12	45 59.9	124 03.2	05/31/85	184
072811	coho	83	ODFW	Sandy	14	46 00.2	124 03.3	05/31/85	174
072958	coho	83	ODFW	Fall Creek	113	47 40.1	124 53.4	06/25/85	233
072959	coho	83	ODFW	Fall Creek	113	47 40.1	124 53.4	06/25/85	243
072962	coho	83	ODFW	Fall Creek	106	47 20.1	124 39.3	06/24/85	264
072962	coho	83	ODFW	Fall Creek	80	46 00.1	124 38.7	06/17/85	300
072963	coho	83	ODFW	Fall Creek	15	46 05.8	124 00.8	05/31/85	165
072963	coho	83	ODFW	Fall Creek	8	45 59.3	124 17.2	05/30/85	189
072963	coho	83	ODFW	Fall Creek	12	45 59.9	124 03.2	05/31/85	179
073026	coho	83	ODFW	Siletz	11	46 00.3	123 59.7	05/31/85	171
073026	coho	83	ODFW	Siletz	30	46 19.9	124 32.5	06/05/85	180
073029	coho	83	ODFW	Cascade	79	46 00.5	124 32.2	06/17/85	168
073032	coho	83	ODFW	Big Creek	80	46 00.1	124 38.7	06/17/85	180
073032	coho	83	ODFW	Big Creek	90	46 20.1	124 25.8	06/20/85	181
073032	coho	83	ODFW	Big Creek	70	45 40.2	124 11.1	06/16/85	164
073045	coho	83	ODFW	Sandy	30	46 19.9	124 32.5	06/05/85	150
073046	coho	83	ODFW	Sandy	79	46 00.5	124 32.2	06/17/85	186
073046	coho	83	ODFW	Sandy	85	46 20.7	124 32.0	06/18/85	195
073046	coho	83	ODFW	Sandy	25	46 00.1	124 07.0	06/02/85	180
073047	coho	83	ODFW	Sandy	31	46 19.9	124 39.7	06/05/85	168
073049	coho	83	ODFW	Sandy	15	46 05.8	124 00.8	05/31/85	152
073049	coho	83	ODFW	Sandy	11	46 00.3	123 59.7	05/31/85	148
073050	coho	83	ODFW	Sandy	81	46 00.4	124 46.2	06/17/85	210
073105	coho	83	ODFW	Sandy	14	46 00.2	124 03.3	05/31/85	182
073106	coho	83	ODFW	Sandy	11	46 00.3	123 59.7	05/31/85	159
073107	coho	83	ODFW	Sandy	87	46 19.8	124 18.3	06/18/85	192
073107	coho	83	ODFW	Sandy	79	46 00.5	124 32.2	06/17/85	183
073107	coho	83	ODFW	Sandy	11	46 00.3	123 59.7	05/31/85	160
073108	coho	83	ODFW	Sandy	78	46 00.2	124 24.7	06/17/85	188
073108	coho	83	ODFW	Sandy	105	47 20.1	124 46.7	06/24/85	216
073108	coho	83	ODFW	Sandy	11	46 00.3	123 59.7	05/31/85	153
073204	coho	83	ODFW	Cascade	14	46 00.2	124 03.3	05/31/85	147
073204	coho	83	ODFW	Cascade	14	46 00.2	124 03.3	05/31/85	156
073204	coho	83	ODFW	Cascade	15	46 05.8	124 00.8	05/31/85	141
073204	coho	83	ODFW	Cascade	11	46 00.3	123 59.7	05/31/85	158
073204	coho	83	ODFW	Cascade	12	45 59.9	124 03.2	05/31/85	155
073204	coho	83	ODFW	Cascade	12	45 59.9	124 03.2	05/31/85	151
073206	coho	83	ODFW	Cascade	79	46 00.5	124 32.2	06/17/85	172

Appendix (continued)

Release data					Recovery data				
Tag code	Species	Brood year	Agency	Hatchery	Set	Latitude	Longitude	Date	Length (mm)
				1985 (continued)					
073206	coho	83	ODFW	Cascade	90	46 20.1	124 25.8	06/20/85	172
073206	coho	83	ODFW	Cascade	94	47 00.0	124 39.7	06/22/85	183
073206	coho	83	ODFW	Cascade	9	46 21.0	124 10.0	05/31/85	134
073207	coho	83	ODFW	Cascade	85	46 20.7	124 32.0	06/18/85	160
073208	coho	83	ODFW	Cascade	15	46 05.8	124 00.8	05/31/85	151
073344	coho	83	ODFW	Cascade	106	47 20.1	124 39.3	06/24/85	240
073344	coho	83	ODFW	Cascade	12	45 59.9	124 03.2	05/31/85	164
111704	coho	83	UW	Coll. Fisheris	99	46 40.2	124 32.8	06/23/85	465
211601	coho	82	TULA	Tulalip Creek	105	47 20.1	124 46.7	06/24/85	495
211626	coho	82	QDNR	(Wild)	24	46 00.3	124 07.0	06/02/85	476
211636	coho	83	QDNR	Quinault NFH	110	47 40.1	124 38.7	06/25/85	201
211643	coho	83	QDNR	Quinault Lake	102	47 00.2	124 53.8	06/24/85	254
603645	coho	83	OAF	Oregon Aqua-Foods	85	46 20.7	124 32.0	06/18/85	517
603709	coho	83	OAF	Oregon Aqua-Foods	60	45 00.0	124 15.2	06/13/85	497
603723	coho	84	OAF	Oregon Aqua-Foods	55	44 39.8	124 18.2	06/12/85	129
621723	coho	82	ANAD	Anadromous, Inc.	58	44 59.9	124 07.9	06/13/85	510
621749	coho	83	ANAD	Anadromous, Inc.	16	45 59.6	124 02.6	06/01/85	492
623024	coho	83	ANAD	Anadromous, Inc.	43	43 59.8	124 16.1	06/11/85	183
623024	coho	83	ANAD	Anadromous, Inc.	41	43 59.7	124 08.9	06/11/85	153
623027	coho	83	ANAD	Anadromous, Inc.	48	44 20.1	124 12.2	06/11/85	166
623126	coho	83	ANAD	Anadromous, Inc.	83	46 19.9	124 18.4	06/18/85	197
623126	coho	83	ANAD	Anadromous, Inc.	48	44 20.1	124 12.2	06/11/85	175
623127	coho	83	ANAD	Anadromous, Inc.	90	46 20.1	124 25.8	06/20/85	201
632809	coho	83	WDF	Naselle	1	46 20.1	124 11.1	05/29/85	143
632814	coho	83	WDF	Nemah	105	47 20.1	124 46.7	06/24/85	213
632815	coho	83	WDF	Nemah	94	47 00.0	124 39.7	06/22/85	237
632820	coho	83	WDF	Humptulips	82	46 19.4	124 10.8	06/18/85	132
632829	coho	83	WDF	Satsop Springs	94	47 00.0	124 39.7	06/22/85	155
632852	coho	82	SQAX	Squaxin Island Pens	105	47 20.1	124 46.7	06/24/85	495
632921	coho	82	WDF	Cowlitz	75	46 00.3	124 02.9	06/17/85	560
632930	coho	82	WDF	Cowlitz	88	46 20.0	124 11.0	06/20/85	545
633010	coho	83	WDF	(Wild)	82	46 19.4	124 10.8	06/18/85	109
633014	coho	82	WDF	Willapa	101	47 00.3	124 47.6	06/24/85	555
633021	coho	82	COOP	George Adams	111	47 40.3	124 46.1	06/25/85	520
633023	coho	82	WDF	Skykomish	101	47 00.3	124 47.6	06/24/85	470
633024	coho	82	SQAX	Squaxin Island Pens	105	47 20.1	124 46.7	06/24/85	483
633026	coho	82	WDF	(Wild)	6	45 58.9	124 25.1	05/30/85	421
633135	coho	83	WDF	Washougal	90	46 20.1	124 25.8	06/20/85	186
633156	coho	83	WDF	Kalama Falls	72	45 40.3	124 25.3	06/16/85	119
633156	coho	83	WDF	Kalama Falls	11	46 00.3	123 59.7	05/31/85	150
633156	coho	83	WDF	Kalama Falls	30	46 19.9	124 32.5	06/05/85	143
633157	coho	83	WDF	Kalama Falls	90	46 20.1	124 25.8	06/20/85	157
633157	coho	83	WDF	Kalama Falls	22	45 59.7	124 07.9	06/01/85	163
633157	coho	83	WDF	Kalama Falls	11	46 00.3	123 59.7	05/31/85	162
633157	coho	83	WDF	Kalama Falls	25	46 00.1	124 07.0	06/02/85	163
633162	coho	83	WDF	Cowlitz	83	46 19.9	124 18.4	06/18/85	180
633232	coho	83	WDF	Kalama Falls	83	46 19.9	124 18.4	06/18/85	118
633232	coho	83	WDF	Kalama Falls	30	46 19.9	124 32.5	06/05/85	163
633232	coho	83	WDF	Kalama Falls	23	46 00.3	124 07.7	06/02/85	148
633232	coho	83	WDF	Kalama Falls	23	46 00.3	124 07.7	06/02/85	145
633233	coho	83	WDF	Kalama Falls	83	46 19.9	124 18.4	06/18/85	187
633233	coho	83	WDF	Kalama Falls	83	46 19.9	124 18.4	06/18/85	181
633249	coho	83	WDF	Cowlitz	12	45 59.9	124 03.2	05/31/85	150
633250	coho	83	WDF	Cowlitz	80	46 00.1	124 38.7	06/17/85	143
633250	coho	83	WDF	Cowlitz	8	45 59.3	124 17.2	05/30/85	148
633252	coho	83	WDF	Cowlitz	30	46 19.9	124 32.5	06/05/85	144
633253	coho	83	WDF	Elkomin	12	45 59.9	124 03.2	05/31/85	169
633254	coho	83	WDF	Elkomin	6	45 58.9	124 25.1	05/30/85	162

Appendix (continued)

Release data					Recovery data				
Tag code	Species	Brood year	Agency	Hatchery	Set	Latitude	Longitude	Date	Length (mm)
				1985 (continued)					
633259	coho	83	WDF	Grays River	90	46 20.1	124 25.8	06/20/85	178
633261	coho	83	WDF	Grays River	30	46 19.9	124 32.5	06/05/85	175
633262	coho	83	WDF	Grays River	90	46 20.1	124 25.8	06/20/85	205
633342	coho	83	WDF	Willapa	80	46 00.1	124 38.7	06/17/85	230
633347	coho	83	WDF	Simpson	89	46 20.4	124 19.0	06/20/85	149
633348	coho	83	WDF	Simpson	79	46 00.5	124 32.2	06/17/85	130
h10603	coho	83	WDF	Humptulips	89	46 20.4	124 19.0	06/20/85	168

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